

REPORT NUMBER: NCAP-MGA-2014-002

**NEW CAR ASSESSMENT PROGRAM (NCAP)
Frontal Barrier Impact Test**

**KIA MOTORS CORPORATION
2014 KIA Forte LX 4-Dr Sedan
NHTSA No.: M20144200**

**MGA RESEARCH CORPORATION
5000 Warren Road
Burlington, WI 53105**



Test Date: July 8, 2013

Final Report Date: July 26, 2013

FINAL REPORT

**U.S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
Office of Crashworthiness Standards
Mail Code: NVS-111
1200 New Jersey Ave, SE
Room W43-410
Washington, DC 20590**

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Prepared by: 
Donna Janovicz, Project Manager

Approved by: 
Ben Fischer, Project Engineer

Approval Date: July 26, 2013

FINAL REPORT ACCEPTANCE BY OCWS:

Division Chief, New Car Assessment Program
NHTSA, Office of Crashworthiness Standards

Date: _____

COTR, New Car Assessment Program
NHTSA, Office of Crashworthiness Standards

Date: _____

Technical Report Documentation Page

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		16. Abstract A 56.3 km/h NCAP Frontal Impact Test was conducted on a 2014 KIA Forte LX 4-Dr Sedan in accordance with the specifications of the Office of Crashworthiness Standards Frontal NCAP Laboratory Test Procedure. This test was conducted to obtain data indicant of FMVSS 208, 212, 219 (partial), 301, and foot well intrusion performance. The test was conducted at MGA Research Corporation in Burlington, Wisconsin, on July 8, 2013. The impact velocity was 56.1 km/h and the ambient temperature at the barrier face at the time of impact was 21.5°C. The target vehicle post-test maximum crush was 548 mm located at the vehicle's centerline. The test vehicle's performance was as follows:																																																					
<table border="1" style="width: 100%; border-collapse: collapse; background-color: #ffff00;"> <thead> <tr> <th rowspan="2">Measurement Description</th> <th rowspan="2">Units</th> <th colspan="2">Threshold</th> <th rowspan="2">Driver ATD</th> <th rowspan="2">Passenger ATD</th> </tr> <tr> <th>50th</th> <th>5th</th> </tr> </thead> <tbody> <tr> <td>Head Injury Criteria (HIC₁₅)</td> <td>N/A</td> <td>700</td> <td>700</td> <td>258</td> <td>269</td> </tr> <tr> <td>Maximum Chest Compression</td> <td>mm</td> <td>63</td> <td>52</td> <td>18</td> <td>14</td> </tr> <tr> <td>Nij</td> <td>N/A</td> <td>1</td> <td>1</td> <td>0.31</td> <td>0.97</td> </tr> <tr> <td>Neck Tension</td> <td>N</td> <td>4170</td> <td>2620</td> <td>1332</td> <td>1595</td> </tr> <tr> <td>Neck Compression</td> <td>N</td> <td>4000</td> <td>2520</td> <td>81</td> <td>473</td> </tr> <tr> <td>Left Femur Force</td> <td>N</td> <td>10008</td> <td>6805</td> <td>458</td> <td>1277</td> </tr> <tr> <td>Right Femur Force</td> <td>N</td> <td>10008</td> <td>6805</td> <td>1491</td> <td>442</td> </tr> </tbody> </table>						Measurement Description	Units	Threshold		Driver ATD	Passenger ATD	50 th	5 th	Head Injury Criteria (HIC ₁₅)	N/A	700	700	258	269	Maximum Chest Compression	mm	63	52	18	14	Nij	N/A	1	1	0.31	0.97	Neck Tension	N	4170	2620	1332	1595	Neck Compression	N	4000	2520	81	473	Left Femur Force	N	10008	6805	458	1277	Right Femur Force	N	10008	6805	1491	442
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SECTION 1 PURPOSE AND SUMMARY OF TEST

PURPOSE

This 56.3 km/h frontal barrier impact test is part of the Vehicle Barrier Impact Testing Program sponsored by the National Highway Traffic Safety Administration (NHTSA) under contract number DTNH22-12-D-00258. The purpose of this test was to obtain vehicle crashworthiness and occupant restraint system performance data for consumer information purposes.

The 56.3 km/h frontal barrier impact was conducted in accordance with the Office of Crashworthiness Standards Frontal NCAP Laboratory Test Procedure.

SUMMARY

A load cell barrier consisting of 176 load cells was impacted by a 2014 KIA Forte LX 4-Dr Sedan at a velocity of 56.1 km/h. The test was performed at MGA Research Corporation on July 8, 2013. Pre-test and post-test photographs of the vehicle and dummies can be found in Appendix A.

Two (2) real-time cameras and fourteen (14) high-speed cameras were used to document the frontal barrier impact event. Camera locations and other pertinent camera information can be found in this report.

One Part 572E 50th percentile male anthropomorphic test device (ATD), was placed in the driver seating position and one Part 572O 5th percentile female test device (ATD) was placed in the right-front passenger seating position according to dummy placement instructions specified in the Frontal NCAP Laboratory Test Procedure.

Both ATDs were fully instrumented with head, chest and pelvis tri-axial accelerometers, chest displacement potentiometers, upper neck transducers, right/left femur load cells, and lower leg instrumentation. Seat belt load cells were also installed on the driver's and passenger's lap and shoulder belts to measure dummy torso and pelvic section loading.

The driver (position 1) ATD (Serial No. 036) and the right-front passenger (position 2) ATD (Serial No. 138) were calibrated previous to this test. Certification details, along with instrumentation calibration data, are found in Appendix C of this report.

The 634 channels of data were recorded on an on-board data acquisition system. Appendix B contains the dummy response data traces.

There was 100 percent windshield retention and no intrusion into the protected zone of the windshield during the event. There was no Stoddard Solvent leakage after the event or during any phase of the static rollover.

The maximum static crush of the vehicle was 548 mm and both the driver and passenger side doors remained closed during the impact event and were operable after the impact.

The driver's visible contact points were as follows: The driver's head and chest contacted the airbag. The driver's head also contacted the headrest. The driver's knees contacted the knee bolster. The passenger's visible contact points were as follows: The passenger's head and chest contacted the airbag. The passenger's head also contacted the headrest. The passenger's knees contacted the glove box.

The occupant data is summarized below:

ATD position	HIC ₁₅	Nij	Neck Tension (N)	Neck Comp. (N)	3ms Chest Clip (Gs)	Chest Disp. (mm)	Left Femur (N)	Right Femur (N)
Driver (50 th)	258	0.31	1332	81	48	18	458	1491
Passenger (5 th)	269	0.97	1595	473	48	14	1277	442

The test data can be found on the NHTSA website at www.nhtsa.dot.gov.

TEST NOTES

Passenger Left Femur Redundant has questionable data after 92 ms.

Load Cell K-16 MY has no valid data after 9 ms.

Load Cell F-01 FX has questionable data.

Load Cell F-01 MZ has questionable data.

Post-test photographs have the incorrect sign labeled O20144200, NCAP 35 MPH FRONTAL, 13071112, 2014 KIA SORENTO.

MGA does not endorse or certify products. The manufacturer's name appears solely for identification purposes.

SECTION 2
OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS

DATA SHEET NO. 1
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2014 KIA Forte LX 4-Dr Sedan
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20144200
Test Date: 07/08/2013

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	M20144200	Traction Control System (TCS)	Yes
Model Year	2014	Power Steering	Yes
Make	KIA	Power Window Auto-Reverse	Yes
Model	Forte	Driver Frontal Airbag	Yes
Body Style	Sedan	Driver Curtain Airbag	Yes
VIN	KNAFK4A6XE5065671	Driver Head/Torso Airbag	No
Body Color	Bright Silver	Driver Torso Airbag	No
Odometer (km/mi)	229 / 142	Driver Torso/Pelvis Airbag	Yes
Engine Displacement (L)	1.8	Driver Pelvis Airbag	No
Type/No. Cylinders	4	Driver Knee Airbag	No
Engine Placement	Lateral	Front Pass. Frontal Airbag	Yes
Transmission Type	Automatic	Front Pass. Curtain Airbag	Yes
Transmission Speeds	6	Front Pass. Head/Torso Airbag	No
Overdrive	Yes	Front Pass. Torso Airbag	No
Final Drive	Front Wheel Drive	Front Pass. Torso/Pelvis Airbag	Yes
Roof Rack	No	Front Pass. Pelvis Airbag	No
Sunroof/T-Top	No	Front Pass. Knee Airbag	No
Running Boards	No	Driver Pretensioner	Yes
Tilt Steering Wheel	Yes	Driver Load Limiter	Yes
Power Seats	No	Front Pass. Pretensioner	Yes
Anti-Lock Brakes (ABS)	Yes	Front Pass. Load Limiter	Yes
Automatic Door Locks (ADLs)	Yes	Other	N/A

Does owner's manual provide instructions to turn off automatic door locks?	No
--	----

DATA FROM CERTIFICATION LABEL

Manufactured By	KIA MOTORS CORPORATION	GVWR (kg)	1760
Date of Manufacture	04/13	GAWR Front (kg)	980
		GAWR Rear (kg)	910

VEHICLE SEATING AND WEIGHT CAPACITY DATA

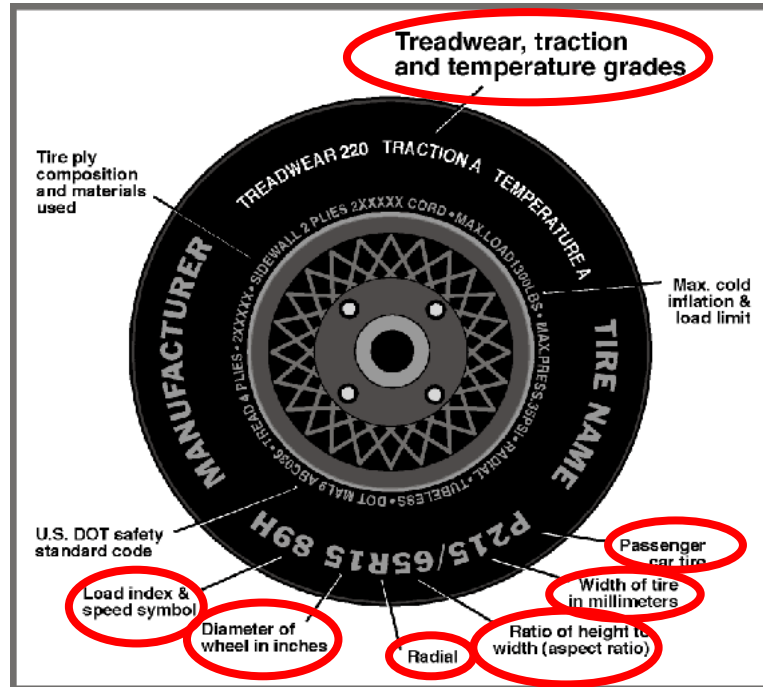
Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Split Bench		
Designated Seating Capacity (DSC)	2	3		5
Capacity Weight (VCW) (kg)				385
Cargo Weight (RCLW) (kg)				45

DATA SHEET NO. 1 (CONTINUED)
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2014 KIA Forte LX 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20144200
 Test Date: 07/08/2013

VEHICLE TIRE INFORMATION



Measured Parameter	Front	Rear
Max. Tire Pressure (kPa)	300	300
Cold Pressure (kPa)	220	220
Recommended Tire Size	P195/65R15	P195/65R15
Tire Size on Vehicle	P195/65R15	P195/65R15
Tire Manufacturer	NEXEN	NEXEN
Tire Model	CP671	CP671
Treadwear	440	440
Traction	A	A
Temperature Grade	A	A
Tire Plies Sidewall	1 Polyester	1 Polyester
Tire Plies Body	1 Polyester, 2 Steel	1 Polyester, 2 Steel
Load Index/Speed Symbol	89T	89T
Tire Material	Rubber	Rubber
DOT Safety Code Left	8E8T BMDL 1313	8E8T BMDL 1313
DOT Safety Code Right	8E8T CMKL 1313	8E8T BMDL 1313

DATA SHEET NO. 1 (CONTINUED)
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2014 KIA Forte LX 4-Dr Sedan
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TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	399.6	251.3		435.5	314.3	
Right	kg	385.6	239.0		414.1	290.8	
Ratio	%	61.6	38.4		58.4	41.6	
Totals	kg	785.2	490.3	1275.5	849.6	605.1	1454.7

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1275.5
Weight of 1 P572E ATD & 1 P572O ATD	kg	140.6
Rated Cargo/Luggage Weight (RCLW)	kg	45
Calculated Vehicle Target Weight (TVTW)	kg	1461.1

TEST VEHICLE ATTITUDES AND CG

	Units	LF	RF	LR	RR	CG (aft of front axle)
As Delivered	mm	673	674	680	685	1038
As Tested	mm	657	665	648	657	1123
Post Test	mm	622	638	647	658	

GENERAL TEST VEHICLE DATA

Measurement Description	Units	Value
Total Vehicle Wheel Base	mm	2700
Total Vehicle Length at Left Side	mm	4278
Total Vehicle Length at Centerline	mm	4570
Total Vehicle Length at Right Side	mm	4278
Weight of Ballast in Cargo Area	kg	11.8
Weight of Vehicle Components Removed	kg	8.6
Amount of Stoddard Solvent in Fuel Tank	L	46.5

List of components removed to meet test weight: Cargo carpet, cargo divider, tire repair kit, rear sill plastic, and right taillight.

DATA SHEET NO. 1 (CONTINUED)
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2014 KIA Forte LX 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20144200
 Test Date: 07/08/2013

TARGET VEHICLE STRUCTURAL MEASUREMENT

	Elements	Pre-Test (mm)
1	Total Length	4570
2	Total Width	1770
3	Bumper Top Height	526
4	Bumper Bottom Height	405
5	Longitudinal Member Top Height	513
6	Distance between Longitudinal Members	927
7	Longitudinal Member Width	64
8	Engine Top Height	842
9	Engine Bottom Height	181
10	Engine and Gearbox Width	985
11	Front Bumper-Engine Distance	401
12	Front Shock Absorber Fixing Height	827
13	Bonnet Leading Edge Height	759
14	Front Shock Absorber Fixing Width	1149
15	Front Bumper – Front Axle Distance	905
16	Front Axle – A-Pillar Distance	416
17	A-Pillar – B-Pillar Distance	1167
18	B-Pillar – Rear Axle Distance	1125
19	B-Pillar – C-Pillar Distance	719
20	Roof Sill Bottom Height	1289
21	Roof Sill Top Height	1418
22	Floor Sill Bottom Height	185
23	Floor Sill Top Height	427

DATA SHEET NO. 2

SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL DATA

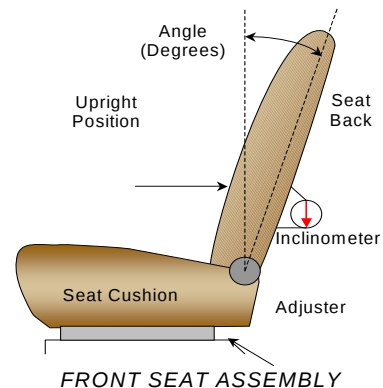
Test Vehicle: 2014 KIA Forte LX 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20144200
 Test Date: 07/08/2013

NOMINAL DESIGN RIDING POSITION

The driver seat back is positioned as close as possible to the manufacturer's design angle. For the passenger seat back, seat back is adjusted following Appendix F, "Driver & Passenger Dummy Seating & Positioning Procedures" in the NCAP Test Procedure dated September 2012.

	Degrees
Driver Seat Back Angle	7.5° on headrest post
Passenger Seat Back Angle	1.9° on headrest post



SEAT FORE/AFT POSITIONS

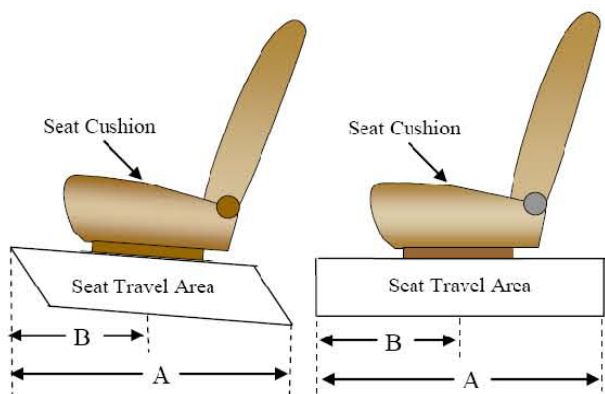
The driver and passenger seat fore/aft positions are adjusted following Appendix F, "Driver & Passenger Dummy Seating & Positioning Procedures" in the NCAP Test Procedure dated September 2012.

	Total Fore/Aft Travel	Placed in Position #
Driver Seat	24 Detents (1 st as 0)	10 th Detent (1 st as 0)
Passenger Seat	24 Detents (1 st as 0)	0 Detent (1 st as 0)

SEAT BELT UPPER ANCHORAGES

The seat belt upper anchorages are positioning following the manufacturer's specified position as listed in Form 1.

	Total # of Positions	Placed in Position #
Driver Seat	4 (1 st as 1)	0 (uppermost as 0)
Passenger Seat	4 (1 st as 1)	0 (uppermost as 0)



DATA SHEET NO. 2 (CONTINUED)
SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL DATA

Test Vehicle: 2014 KIA Forte LX 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20144200
 Test Date: 07/08/2013

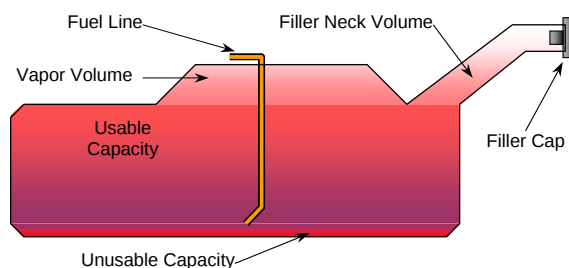
FUEL TANK CAPACITY DATA

	Liters
Usable Capacity of "Standard Tank"	50.0
Usable Capacity of "Optional Tank"	
92-94% of Usable Capacity	46.0 to 47.0
Actual Amount of Solvent used	46.5
1/3 of Usable Capacity	16.7

FUEL PUMP

Describe the fuel pump type, its behavior, and the location of the fuel filler pipe.

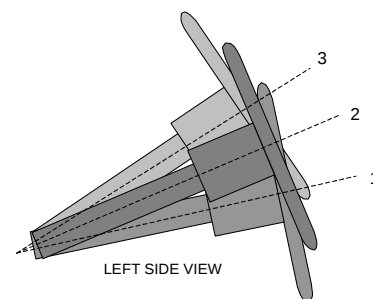
The vehicle is equipped with an electric fuel pump. Fuel pump will pump fuel when key is in "ON" position. The fuel pipe is on the left side.



VEHICLE FUEL TANK ASSEMBLY

STEERING COLUMN ADJUSTMENT

Steering wheel and column adjustments are made so that the steering wheel hub is at the geometric center of the locus it describes when moved through its full range of motion. An aluminum plate is placed across the rim of the steering wheel, an inclinometer is placed on the plate and the angle is measured.



LEFT SIDE VIEW

STEERING COLUMN ASSEMBLY

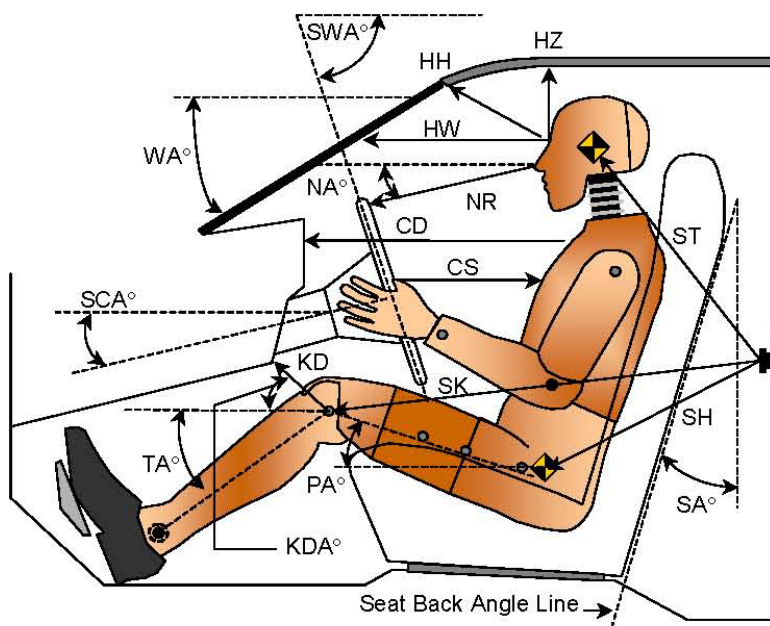
STEERING COLUMN POSITION

	Degrees	Fore/Aft Position (mm)
Lowermost Position 1	69.2	225
Geometric Center Position 2	67.0	205
Uppermost Position 3	64.7	185
Telescoping Steering Wheel Travel		40
Test Position	67.0	185

DATA SHEET NO. 3 DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2014 KIA Forte LX 4-Dr Sedan
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20144200
Test Date: 07/08/2013



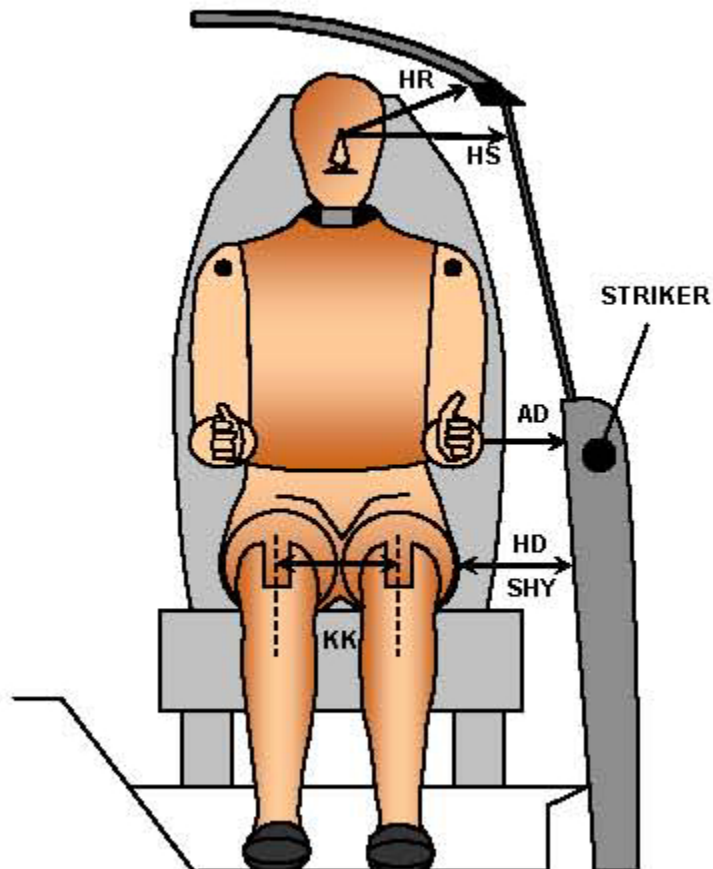
LEFT SIDE VIEW

Code	Measurement Description	Driver S/N 036		Passenger S/N 138	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
WA°	Windshield Angle		22.4		
SWA°	Steering Wheel Angle		67.0		
SCA°	Steering Column Angle		23.0		
SA°	Seat Back Angle (on headrest post)		7.5		1.9
HZ	Head to Roof (Z)	183	90.0	206	90.0
HH	Head to Header	352	21.3	275	47.0
HW	Head to Windshield	681	0.0	710	0.0
NR	Nose to Rim	413	9.7		
CD	Chest to Dash	535		419	
CS	Chest to Steering Hub	332	3.6		
RA	Rim to Abdomen	217	0.0		
KDL	Left Knee to Dash	191	31.0	130	35.2
KDR	Right Knee to Dash	182	27.5	144	34.9
PA°	Pelvic Angle		23.2		21.7
TA°	Tibia Angle		41.8		41.4
SK	Striker to Knee	618	98.2	721	104.9
ST	Striker to Head	434	13.3	440	38.2
SH	Striker to H-Point	337	138.0	433	127.6

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2014 KIA Forte LX 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20144200
 Test Date: 07/08/2013



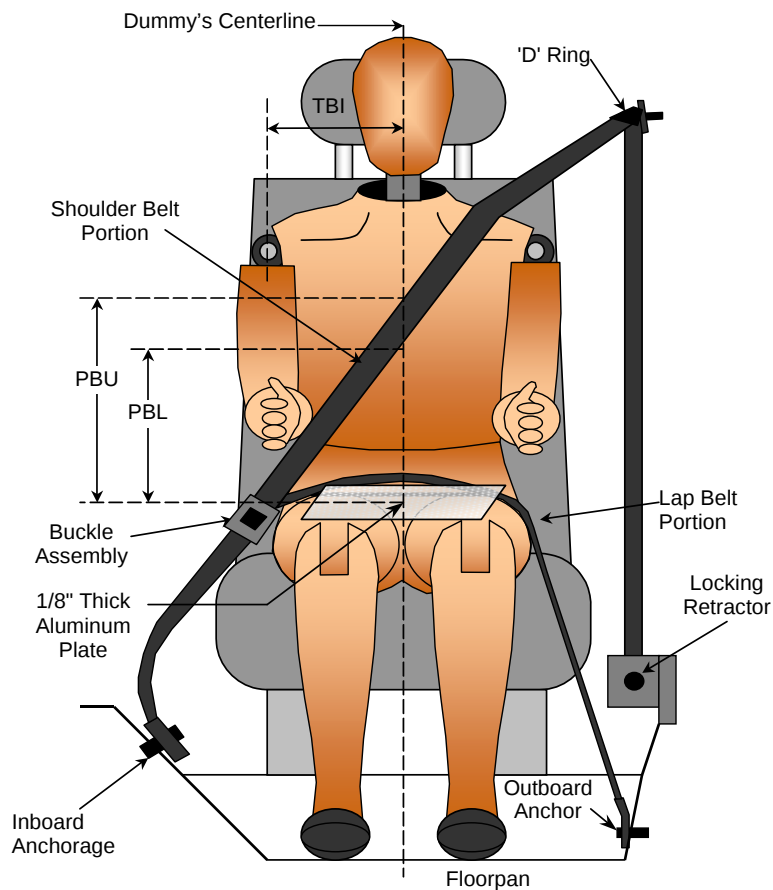
FRONT VIEW OF DUMMY

Code	Measurement Description	Driver S/N 036	Passenger S/N 138
		Length (mm)	
AD	Arm to Door	132	96
HD	H-Point to Door	161	182
HR	Head to Side Header	206	257
HS	Head to Side Window	318	360
KK	Knee to Knee	355	229
SHY	Striker to H-Point (Y Direction)	275	320
AA	Ankle to Ankle	360	180

DATA SHEET NO. 5 SEAT BELT POSITIONING DATA

Test Vehicle: 2014 KIA Forte LX 4-Dr Sedan
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20144200
Test Date: 07/08/2013



FRONT VIEW OF DUMMY

SEAT BELT POSITIONING MEASUREMENTS

Measurement Description	Units	Driver	Passenger
PBU - Top surface of reference to belt upper edge	mm	375	330
PBL - Top surface of reference to belt lower edge	mm	315	240

BELT LENGTH DATA

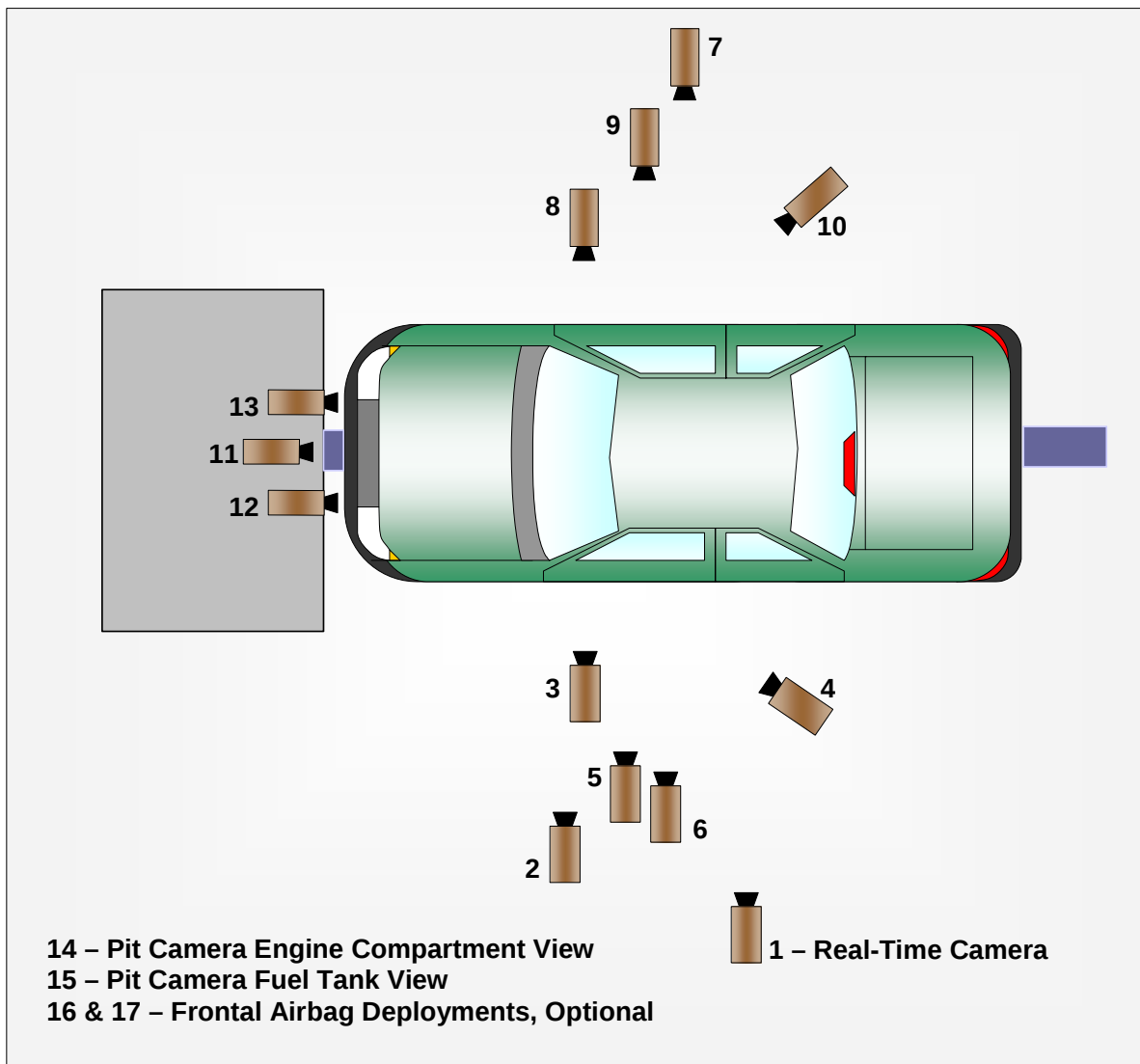
Measurement Description	Units	Driver	Passenger
Shoulder Belt Length as measured on ATD	mm	840	930
Lap Belt Length as measured on ATD	mm	640	715
Remainder of belt on reel	mm	1600	1455
Total Belt Length for Continuous Webbing Systems	mm	3080	3100

DATA SHEET NO. 6
HIGH-SPEED CAMERA LOCATIONS AND DATA

Test Vehicle: 2014 KIA Forte LX 4-Dr Sedan
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20144200
Test Date: 07/08/2013

CAMERA POSITIONS FOR FRONTAL IMPACTS



DATA SHEET NO. 6 (CONTINUED)
CAMERA LOCATIONS AND DATA

Test Vehicle: 2014 KIA Forte LX 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20144200
 Test Date: 07/08/2013

CAMERA LOCATIONS

No.	Camera View	Coordinates (mm)			Lens (mm)	Speed (fps)
		X*	Y*	Z*		
1	Real-Time Left Overall					30
2	Driver Close-Up	1610	-6240	-1810	35	1000
3	Left Front Half	1280	-4970	-1360	24	1000
4	Left Angle	5450	-5130	-1910	50	1000
5	Steering Column - Top	680	-4810	-1240	24	1000
6	Steering Column - Bottom	660	-4780	-840	24	1000
7	Right Overall	2120	6730	-1430	20	1000
8	Passenger Close-Up	1510	6540	-1760	35	1000
9	Right Front Half	1290	4950	-1340	24	1000
10	Right Angle	5710	4860	-1860	50	1000
11	Windshield	-1780	0	-2810	24	1000
12	Driver Windshield	-1470	-450	-2030	8.5	1000
13	Passenger Windshield	-1470	450	-2030	8.5	1000
14	Pit Front	1070	0	3150	24	1000
15	Pit Rear	3010	0	3150	24	1000
16	Onboard Driver Side (optional)					
17	Onboard Passenger Side (optional)					
18	Real-Time Pan View					30

***COORDINATES:**

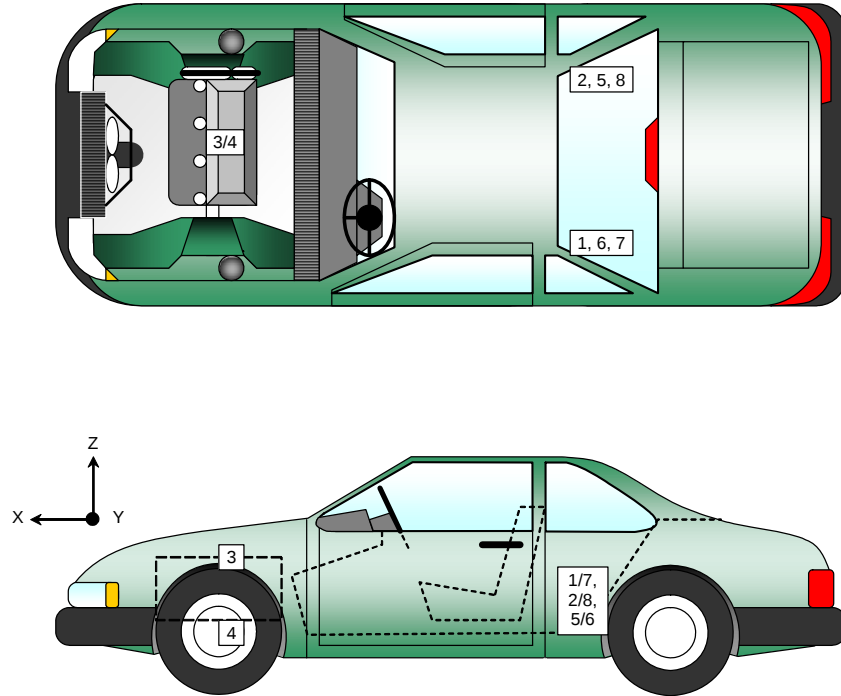
- +X = forward of impact plane
- +Y = right of monorail centerline
- +Z = below ground level

Cameras 16 & 17 were not used for this test.

DATA SHEET NO. 7 **VEHICLE ACCELEROMETER LOCATIONS**

Test Vehicle: 2014 KIA Forte LX 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20144200
 Test Date: 07/08/2013



VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

No.	Accelerometer Location	Measurements (mm)		
		X	Y	Z
1	Left Rear Crossmember Accelerometer – X Direction	1766	-464	-224
2	Right Rear Crossmember Accelerometer – X Direction	1766	464	-224
3	Engine Top X	3819	52	-826
4	Engine Bottom X	3863	145	-175
5	Left Rear Crossmember Accelerometer – Z Direction	1766	-464	-224
6	Right Rear Crossmember Accelerometer – Z Direction	1766	464	-224
7	Left Rear Crossmember Accelerometer Redundant – X Direction	1766	-464	-224
8	Right Rear Crossmember Accelerometer Redundant – X Direction	1766	464	-224

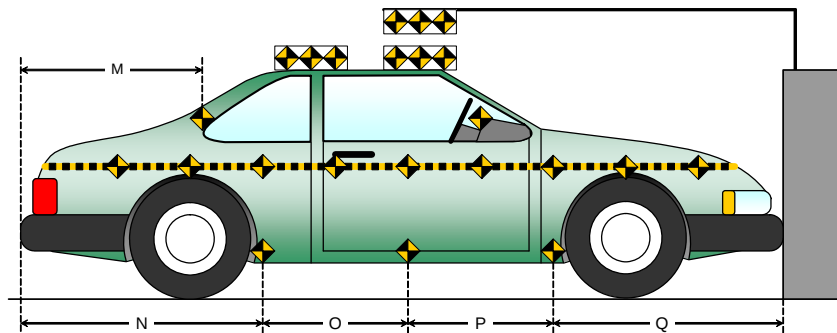
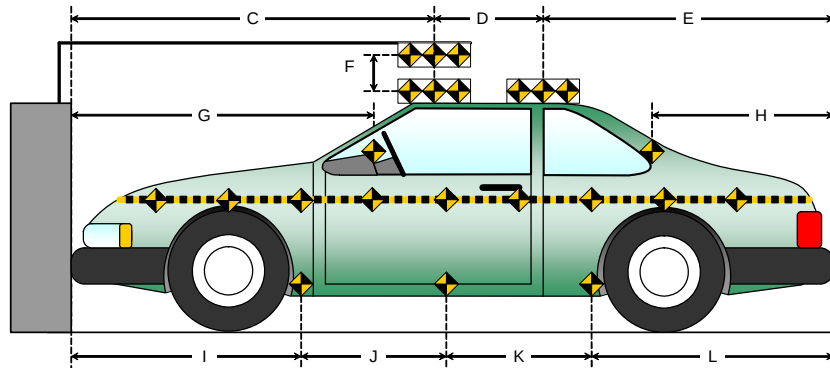
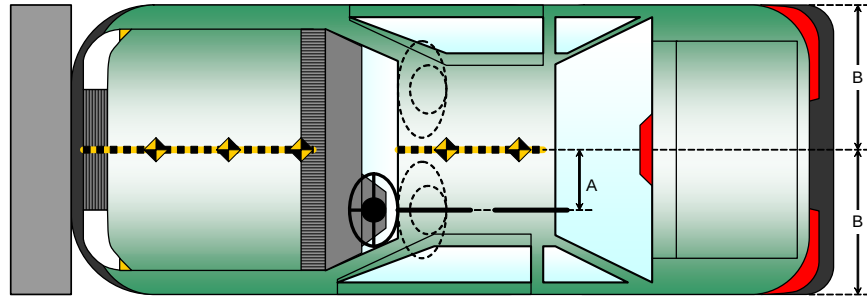
Reference Points: X - Rear Surface of Vehicle (+ forward)
 Y - Vehicle Centerline (+ to right)
 Z - Ground Plane (+ down)

DATA SHEET NO. 8
PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

Test Vehicle: 2014 KIA Forte LX 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20144200
 Test Date: 07/08/2013

Item	Value (mm)
A	372
B	885
C	2305
D	650
E	1615
F	330
G	
H	956
I	1296
J	942
K	942
L	1390
M	956
N	1390
O	942
P	942
Q	1296



DATA SHEET NO. 9 **LOAD CELL LOCATIONS ON FIXED BARRIER**

Test Vehicle: 2014 KIA Forte LX 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20144200
 Test Date: 07/08/2013

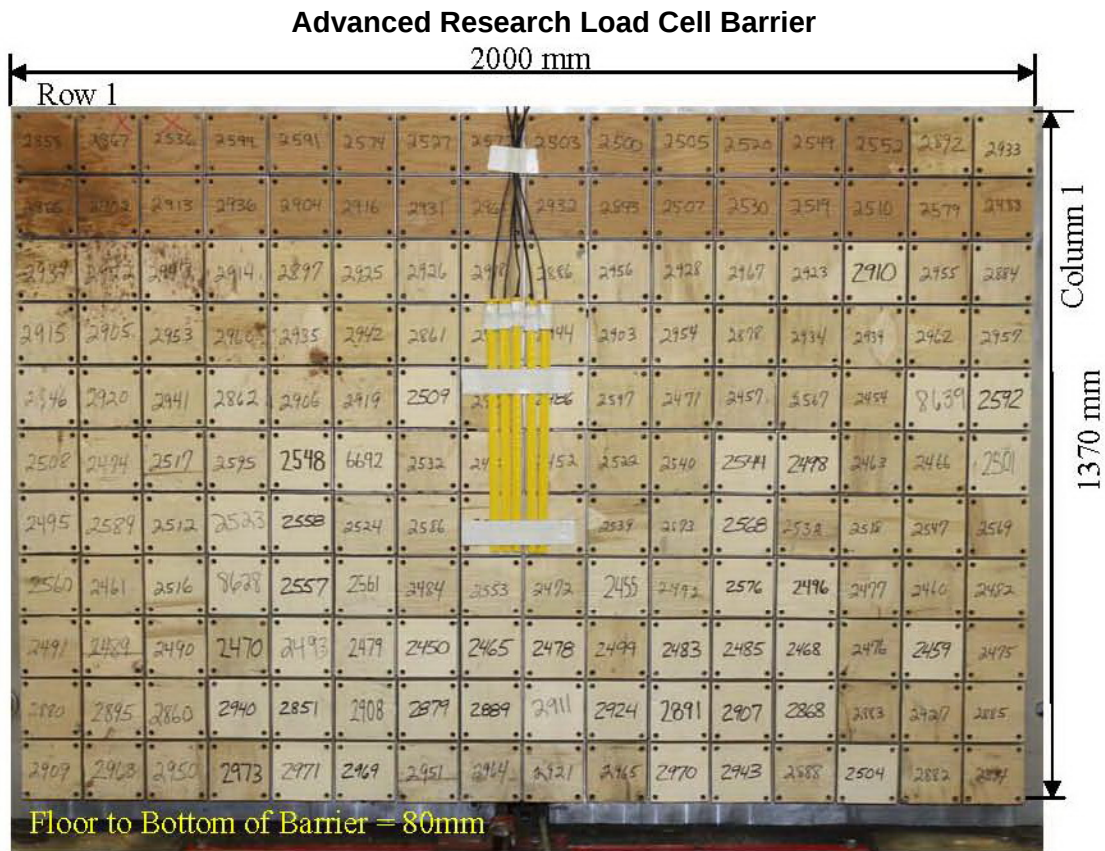


Photo for Reference Only

Centerline															
A-16	A-15	A-14	A-13	A-12	A-11	A-10	A-09	A-08	A-07	A-06	A-05	A-04	A-03	A-02	A-01
B-16	B-15	B-14	B-13	B-12	B-11	B-10	B-09	B-08	B-07	B-06	B-05	B-04	B-03	B-02	B-01
C-16	C-15	C-14	C-13	C-12	C-11	C-10	C-09	C-08	C-07	C-06	C-05	C-04	C-03	C-02	C-01
D-16	D-15	D-14	D-13	D-12	D-11	D-10	D-09	D-08	D-07	D-06	D-05	D-04	D-03	D-02	D-01
E-16	E-15	E-14	E-13	E-12	E-11	E-10	E-09	E-08	E-07	E-06	E-05	E-04	E-03	E-02	E-01
F-16	F-15	F-14	F-13	F-12	F-11	F-10	F-09	F-08	F-07	F-06	F-05	F-04	F-03	F-02	F-01
G-16	G-15	G-14	G-13	G-12	G-11	G-10	G-09	G-08	G-07	G-06	G-05	G-04	G-03	G-02	G-01
H-16	H-15	H-14	H-13	H-12	H-11	H-10	H-09	H-08	H-07	H-06	H-05	H-04	H-03	H-02	H-01
I-16	I-15	I-14	I-13	I-12	I-11	I-10	I-09	I-08	I-07	I-06	I-05	I-04	I-03	I-02	I-01
J-16	J-15	J-14	J-13	J-12	J-11	J-10	J-09	J-08	J-07	J-06	J-05	J-04	J-03	J-02	J-01
K-16	K-15	K-14	K-13	K-12	K-11	K-10	K-09	K-08	K-07	K-06	K-05	K-04	K-03	K-02	K-01

Load Cells are 121 mm x 121 mm with a 7 mm gap in between each load cell.

DATA SHEET NO. 10
TEST VEHICLE SUMMARY OF RESULTS

Test Vehicle: 2014 KIA Forte LX 4-Dr Sedan
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20144200
Test Date: 07/08/2013

INSTRUMENTATION

Driver Dummy Data Channels	52
Passenger Dummy Data Channels	46
Vehicle Structure Accelerometers	8
Barrier Channels	528
Total	634

CAMERA COVERAGE

High-Speed Vehicle Onboard	0
High-Speed Offboard	14
Real-Time	2
Total	16

**DATA SHEET NO. 11
POST-TEST OBSERVATIONS**

Test Vehicle: 2014 KIA Forte LX 4-Dr Sedan
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20144200
Test Date: 07/08/2013

TEST DUMMY INFORMATION AND CONTACT LOCATIONS

Description	Driver	Passenger
Dummy Type / Serial No.	HIIL 50% / 036	HIIL 5% / 138
Head Contact	Airbag, Headrest	Airbag, Headrest
Upper Torso Contact	Airbag	Airbag
Lower Torso Contact	None	None
Left Knee Contact	Knee Bolster	Glove Box
Right Knee Contact	Knee Bolster	Glove Box

DOOR OPENING AND SEAT TRACK INFORMATION

Description	Driver	Passenger
Locked/Unlocked Doors	Doors were locked	Doors were locked
Front Door Opening	Door remained closed and latched; Door opened without tools	Door remained closed and latched; Door opened without tools
Rear Door Opening	Door remained closed and latched; Door opened without tools	Door remained closed and latched; Door opened without tools
Seat Track Shift (mm)	0	0
Seat Back Failure	None	None

POST TEST STRUCTURAL OBSERVATIONS

Critical Areas of Performance	Observations and Conclusions
Windshield Damage	None
Window Damage	None
Other Notable Effects	None

VEHICLE REBOUND FROM BARRIER

Measured Parameter	Units	Value
Left Side	mm	2730
Center	mm	2755
Right Side	mm	2735
Average	mm	2740

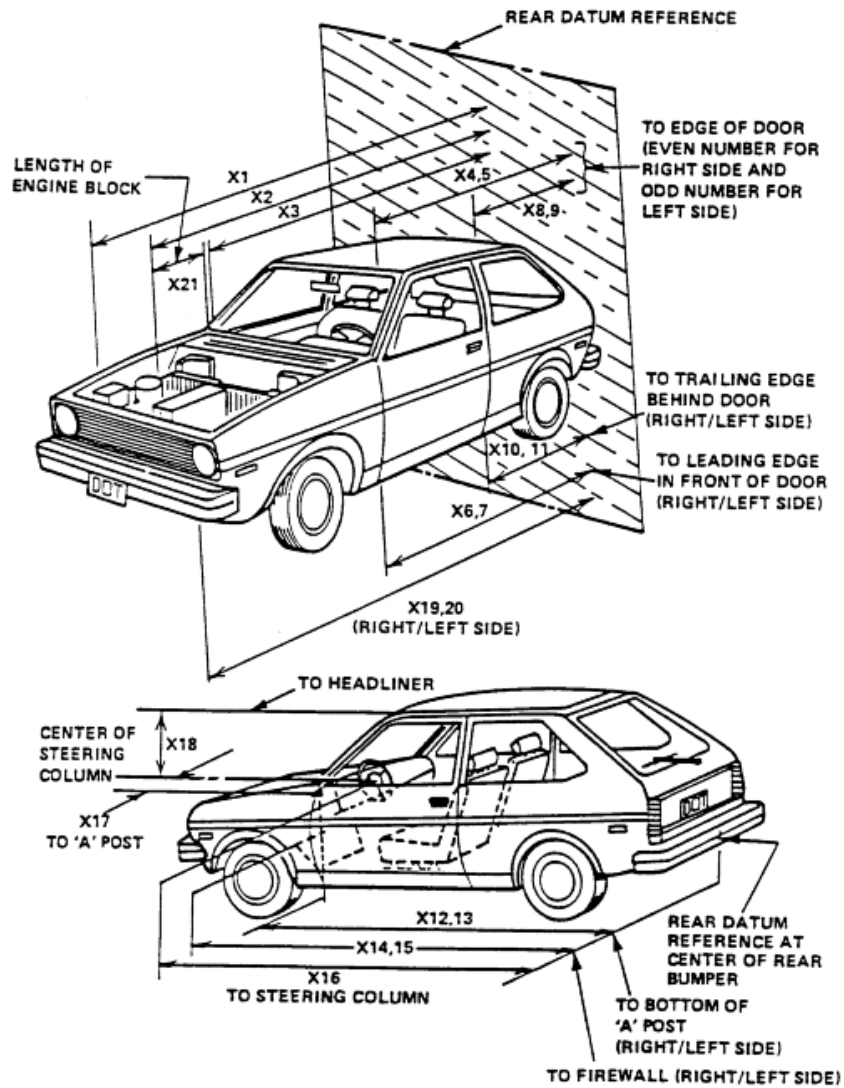
SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Type	Left Front (Driver) P1		Right Front (Passenger) P2	
	Mounted	Deployed	Mounted	Deployed
Frontal Airbag	Yes	Yes	Yes	Yes
Curtain Side Airbag	Yes	No	Yes	No
Torso/Pelvis Side Airbag	Yes	No	Yes	No
Knee Airbag	No		No	
Seat Belt Pretensioner	Yes	Yes	Yes	Yes
Seat Belt Load Limiter	Yes		Yes	

DATA SHEET NO. 12 VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2014 KIA Forte LX 4-Dr Sedan
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20144200
Test Date: 07/08/2013



DATA SHEET NO. 12 (CONTINUED)
VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2014 KIA Forte LX 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20144200
 Test Date: 07/08/2013

RSOV (Rear Surface of Vehicle)

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
1	Total Length of Vehicle at Centerline	mm	4570	4022	548
2	RSOV to Front of Engine	mm	4093	3884	209
3	RSOV to Firewall	mm	3692	3644	48
4	RSOV to Upper Leading Edge of Right Door	mm	3195	3202	-7
5	RSOV to Upper Leading Edge of Left Door	mm	3195	3205	-10
6	RSOV to Lower Leading Edge of Right Door	mm	3174	3164	10
7	RSOV to Lower Leading Edge of Left Door	mm	3174	3167	7
8	RSOV to Upper Trailing Edge of Right Door	mm	2063	2085	-22
9	RSOV to Upper Trailing Edge of Left Door	mm	2063	2081	-18
10	RSOV to Lower Trailing Edge of Right Door	mm	2081	2070	11
11	RSOV to Lower Trailing Edge of Left Door	mm	2081	2071	10
12	RSOV to Bottom of "A" Post of Right Side	mm	3207	3199	8
13	RSOV to Bottom of "A" Post of Left Side	mm	3207	3204	3
14	RSOV to Firewall, Right Side	mm	3624	3599	25
15	RSOV to Firewall, Left Side	mm	3624	3553	71
16	RSOV to Steering Column	mm	2648	2744	-96
17	Center of Steering Column to "A" Post	mm	399	428	-29
18	Center of Steering Column to Headliner	mm	434	483	-49
19	RSOV to Right Side of Front Bumper	mm	4278	3997	281
20	RSOV to Left Side of Front Bumper	mm	4278	3926	352
21	Length of Engine Block	mm	523	523	0
RD	RSOV to Right Side of Dash Panel	mm	2943	2945	-2
CD	RSOV to Center of Dash Panel	mm	2915	2916	-1
LD	RSOV to Left Side of Dash Panel	mm	2930	2941	-11

DATA SHEET NO. 13
ACCIDENT INVESTIGATION DIVISION DATA

Test Vehicle: 2014 KIA Forte LX 4-Dr Sedan
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20144200
Test Date: 07/08/2013

VEHICLE INFORMATION

VIN: KNAFK4A6XE5065671 Wheelbase (mm): 2700
Vehicle Size Category: Passenger Test Weight (kg): 1454.7

ACCELEROMETER DATA

Accelerometer Locations: As per measurements on Page 15

Cal. Procedure/Interval: MGA procedure / 6 month

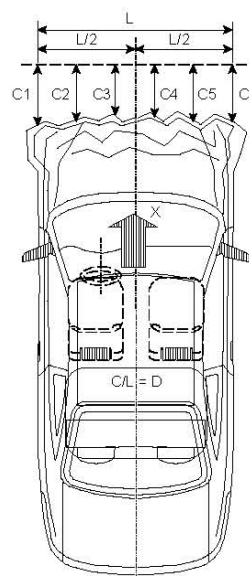
Integration Algorithm: Trapezoidal

Linearity: > 99%

Impact Velocity (km/h): 56.1

Velocity Change (km/h): 62.9

Time of Separation (msec): 89.4



CRUSH PROFILE

Collision Deformation Classification: Frontal

Midpoint of Damage: Centerline

Damage Region Length (mm): 1632

Impact Mode: Frontal

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush zone 1 at left side	mm	4278	3926	352
C2	Crush zone 2 at left side	mm	4447	3997	450
C3	Crush zone 3 at left side	mm	4513	4009	504
C4	Crush zone 4 at right side	mm	4513	3996	517
C5	Crush zone 5 at right side	mm	4447	3987	460
C6	Crush zone 6 at right side	mm	4278	3997	281
L	C1 TO C6	mm	1632	1446	186

DATA SHEET NO. 14
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2014 KIA Forte LX 4-Dr Sedan
Test Program: NCAP Frontal Barrier Impact Test

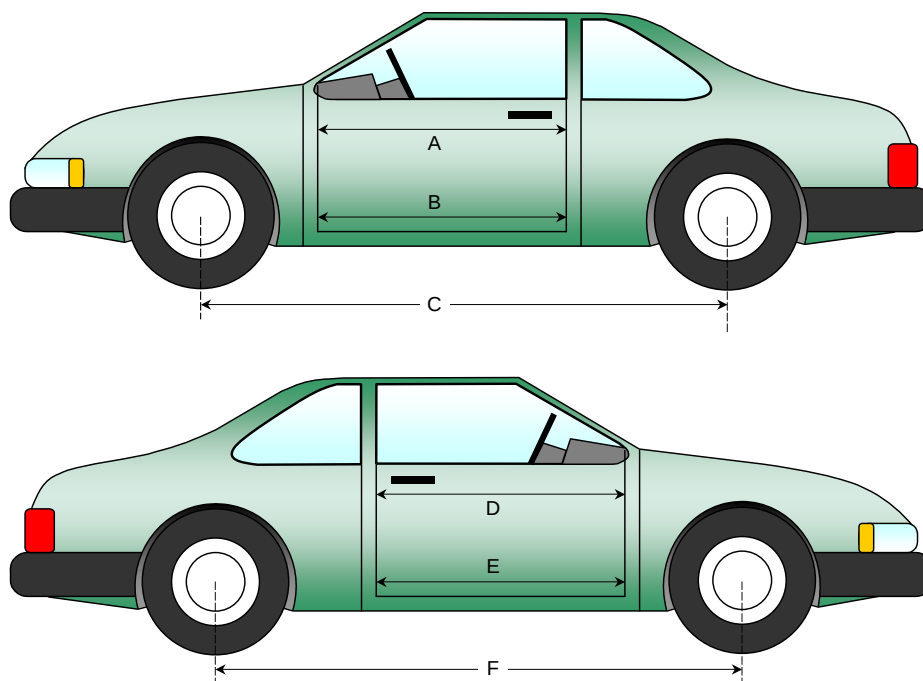
NHTSA No.: M20144200
Test Date: 07/08/2013

DOOR OPENING WIDTH

Item	Description	Units	Pre-Test	Post-Test	Difference
A	Left Side Upper	mm	1013	1011	2
B	Left Side Lower	mm	970	964	6
D	Right Side Upper	mm	1013	1012	1
E	Right Side Lower	mm	970	965	5

WHEELBASE MEASUREMENTS

Item	Description	Units	Pre-Test	Post-Test	Difference
C	Left Side Wheelbase	mm	2700	2658	42
F	Right Side Wheelbase	mm	2700	2669	31



DATA SHEET NO. 14 (CONTINUED)
VEHICLE INTRUSION MEASUREMENTS

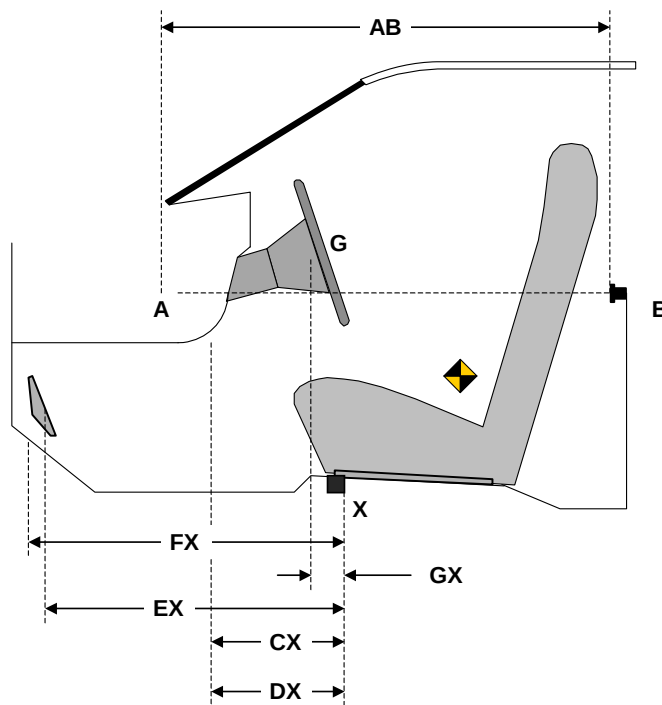
Test Vehicle: 2014 KIA Forte LX 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20144200
 Test Date: 07/08/2013

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Difference
AB	Door Opening (Inside Window Jam)	mm	838	838	0
CX	Left Knee Bolster to X	mm	302	309	-7
DX	Right Knee Bolster to X	mm	322	329	-7
EX	Brake Pedal to X	mm	637	624	13
FX	Foot Rest to X	mm	709	556	153
GX	Center of Steering Column Wheel Hub to X	mm	55	120	-65

X = Front of Seat Track (stationary)



DRIVER COMPARTMENT

DATA SHEET NO. 15
SUMMARY OF FMVSS 212, FMVSS 219 (PARTIAL) DATA, AND 301 DATA

Test Vehicle: 2014 KIA Forte LX 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20144200
 Test Date: 07/08/2013

Windshield Mounting Details:

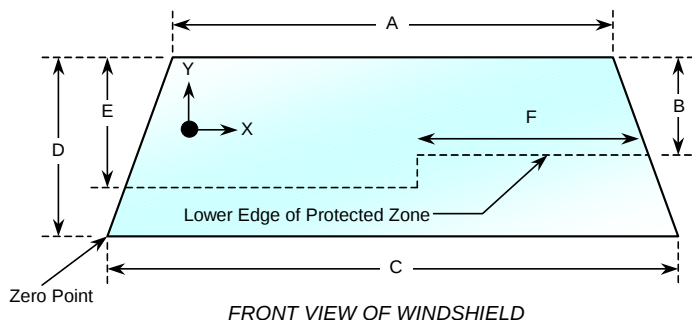
Windshield glass is secured to the vehicle frame with a rubber trim and glue.

The standard requires that the post-test retention measurement be a minimum of 75 percent of the pre-test total periphery measurement for vehicles not equipped with occupant passive restraints and 50 percent for each side of the windshield for vehicles which are equipped with occupant passive restraints.

Temperature of windshield molding during test: 21.5°C

WINDSHIELD PERIPHERY MEASUREMENTS

Measurement	Pre-Test (mm)	Post-Test (mm)	% of Retention
Left Side	2189	2189	100
Right Side	2189	2189	100
Total	4378	4378	100



Item	Units	Value
A	mm	1158
B	mm	528
C	mm	1438
D	mm	891
E	mm	581
F	mm	461

AREA OF PROTECTED ZONE FAILURES - NONE

A. Provide coordinates of the area that the protected zone was penetrated more than 0.25 inches by a vehicle component other than one that is normally in contact with the windshield. **None**

X	Y

B. Provide coordinates of the area beneath the protected zone that the inner surface of the windshield was penetrated by a vehicle component. **None**

X	Y

DATA SHEET NO. 15 (CONTINUED)
SUMMARY OF FMVSS 212, FMVSS 219 (PARTIAL), AND 301 DATA

Test Vehicle: 2014 KIA Forte LX 4-Dr Sedan
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20144200
Test Date: 07/08/2013

FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

Temperature at Time of Impact: 21.5°C Test Time: 2:33 p.m.

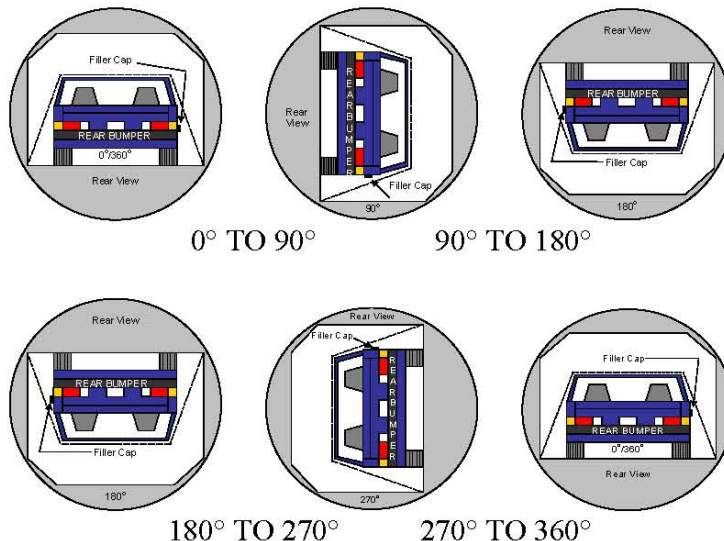
- A. From impact until vehicle motion ceases: 0 oz.
(Maximum allowable = 1 oz.)
- B. For the 5 minute period after motion ceases: 0 oz.
(Maximum allowable = 5 oz.)
- C. For the following 25 minutes: 0 oz.
(Maximum allowable = 1 oz./minute)
- D. Spillage: None

DATA SHEET NO. 16 **FMVSS 301 STATIC ROLLOVER RESULTS**

Test Vehicle: 2014 KIA Forte LX 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20144200
 Test Date: 07/08/2013

1. The specified fixture rollover rate for each 90° of rotation is 60 to 180 seconds.
2. The position hold time at each position is 300 seconds (minimum).
3. Details of Stoddard Solvent spillage: **None**



SOLVENT COLLECTION TIME TABLE IN SECONDS

Test Phase	Rotation Time	Hold Time	Total Time
0° to 90°	110	300	410
90° to 180°	111	300	411
180° to 270°	110	300	410
270° to 360°	111	300	411

FMVSS 301 SPILLAGE TABLE (units in ounces)

Test Phase	First 5 Minutes	Sixth Minute	Seventh Minute	Eight Minute
0° to 90°	0	0	0	0
90° to 180°	0	0	0	0
180° to 270°	0	0	0	0
270° to 360°	0	0	0	0

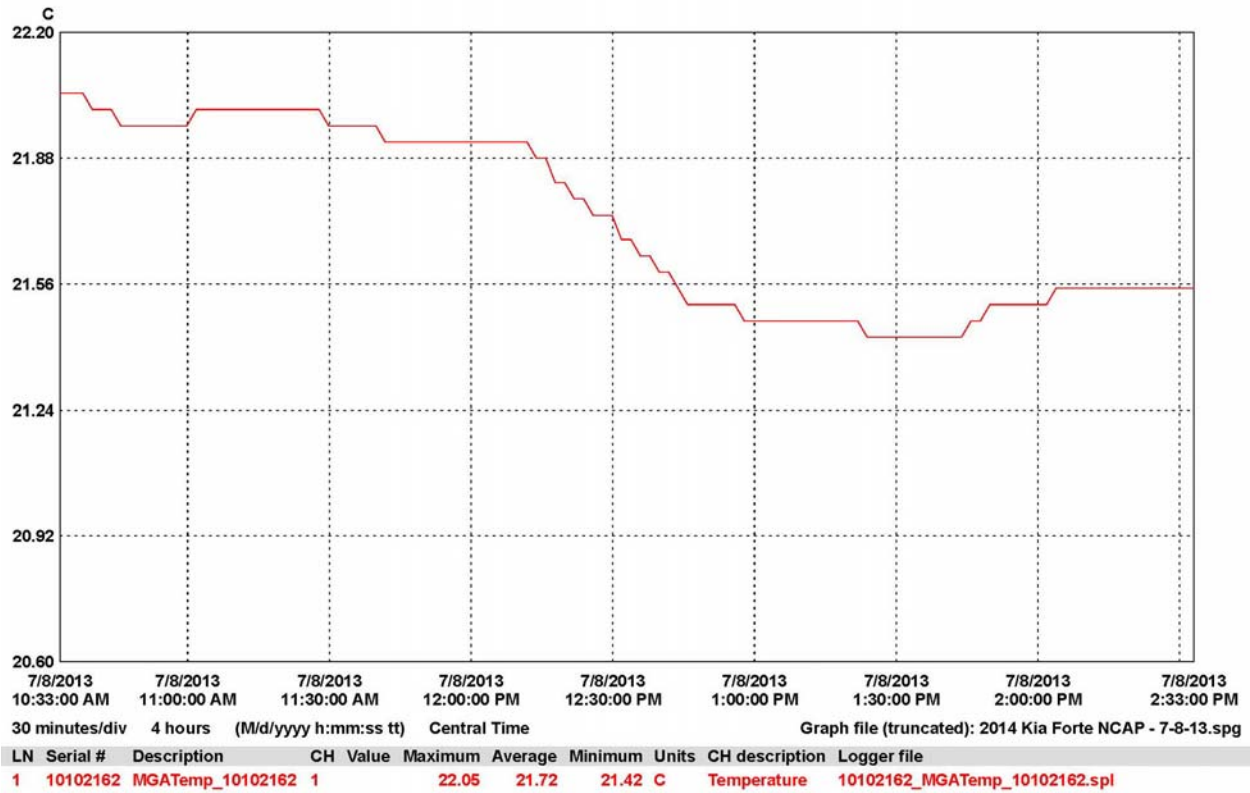
SOLVENT SPILLAGE LOCATION TABLE

Test Phase	Spillage Location
0° to 90°	
90° to 180°	
180° to 270°	
270° to 360°	

DATA SHEET NO. 17 **DUMMY/VEHICLE TEMPERATURE STABILIZATION DATA**

Test Vehicle: 2014 KIA Forte LX 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20144200
 Test Date: 07/08/2013



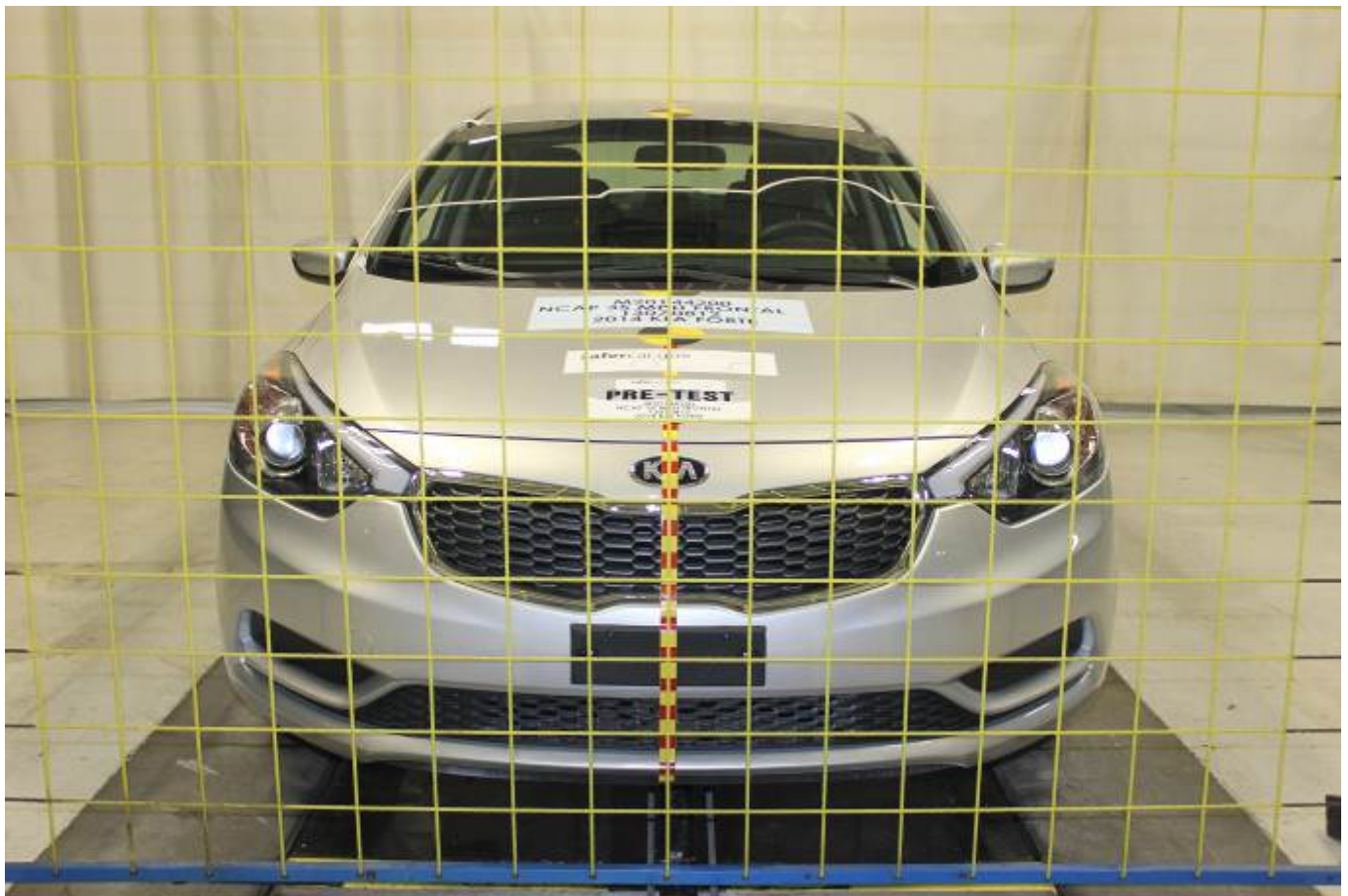
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Load Cell Location



Load Cell Wall



Manufacturer's Label



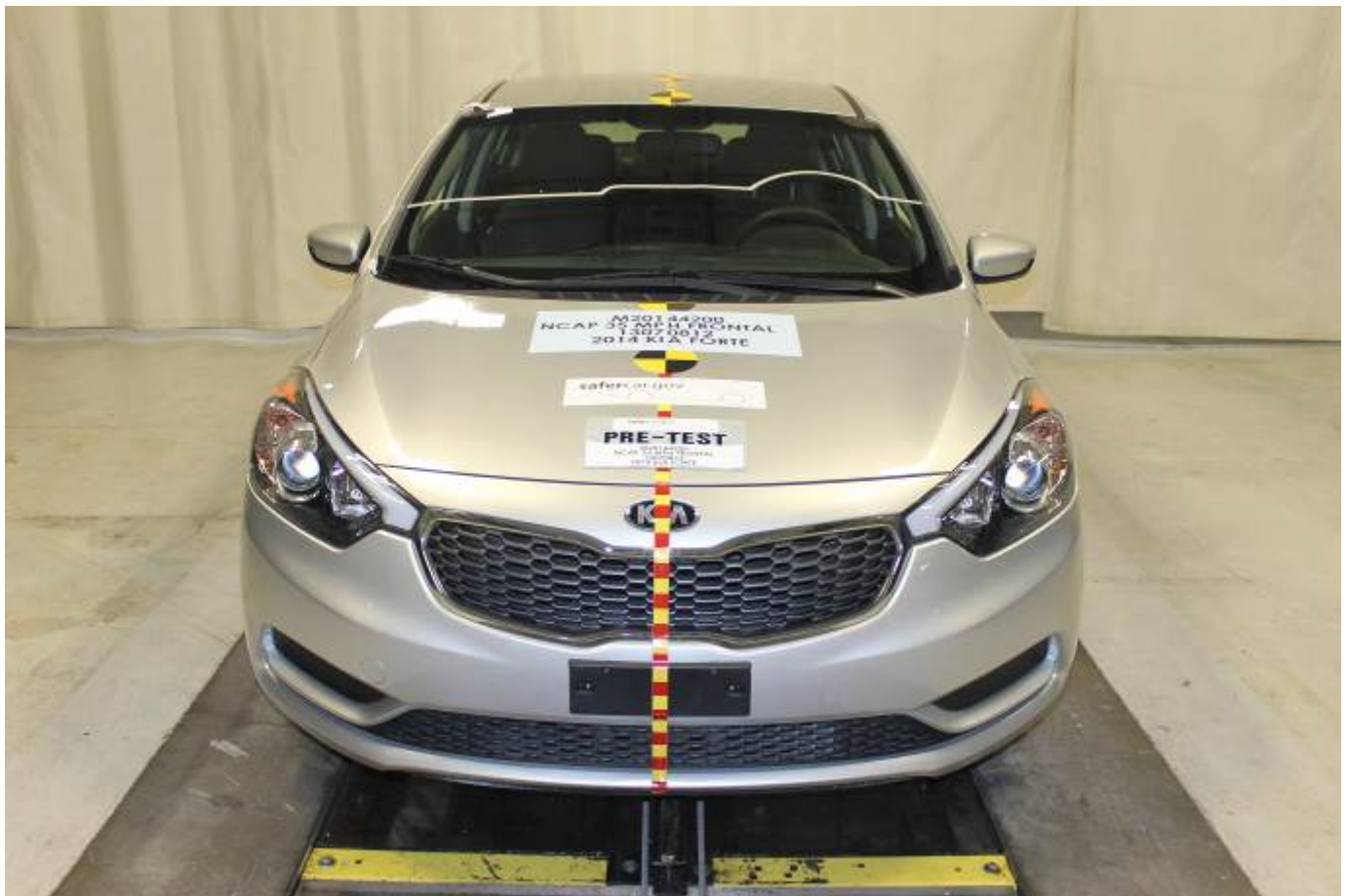
Tire Placard



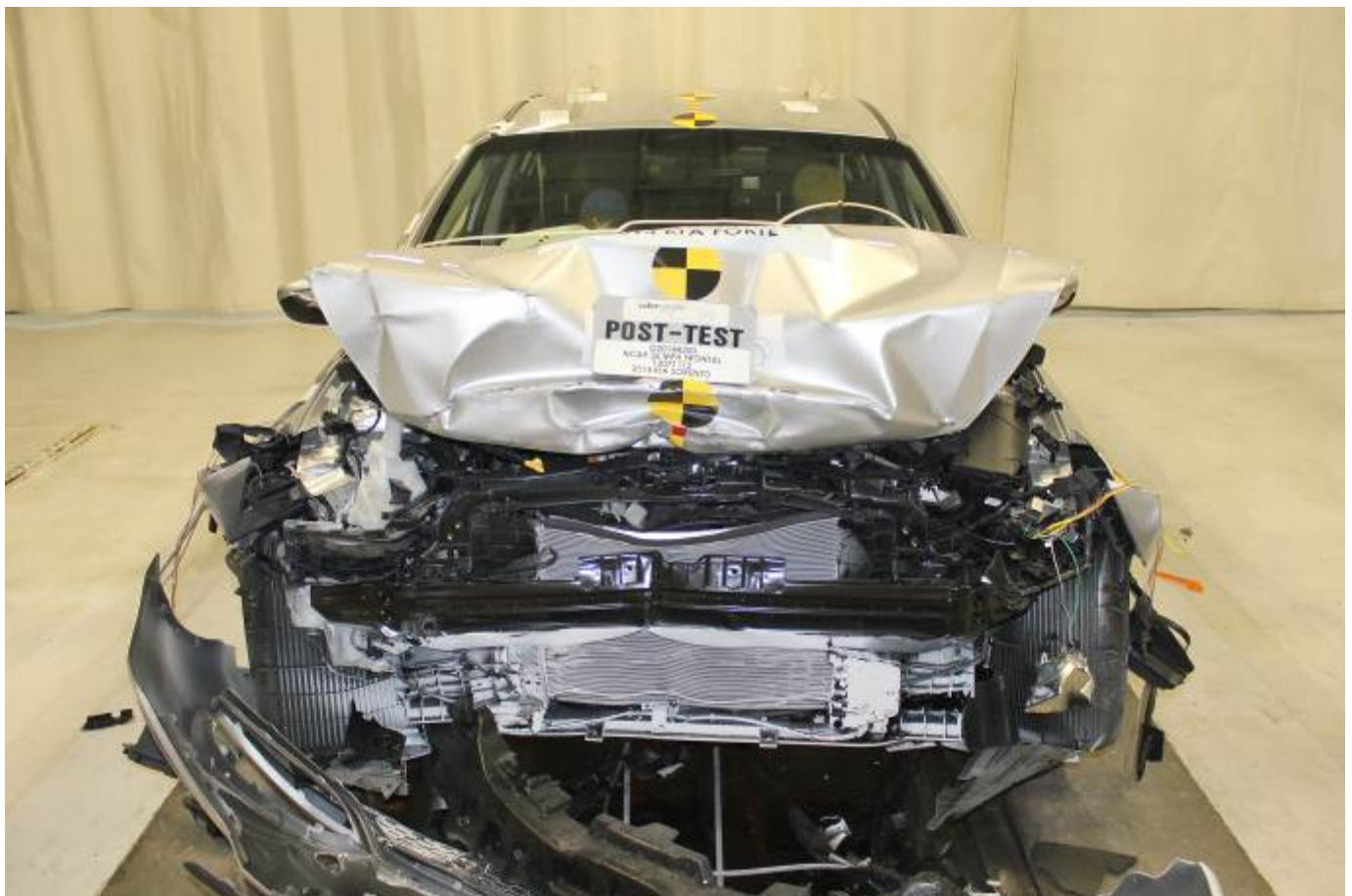
2014 KIA Forte Frontal As Delivered



Left Rear 3-4 View, As Received



Pre-Test Front View of Test Vehicle



Post-Test Front View of Test Vehicle



Pre-Test Left View of Test Vehicle



Post-Test Left View of Test Vehicle



Pre-Test Right View of Test Vehicle



Post-Test Right View of Test Vehicle



Pre-Test Right Front 3-4 View



Post-Test Right Front 3-4 View



Pre-Test Left Rear 3-4 View



Post-Test Left Rear 3-4 View



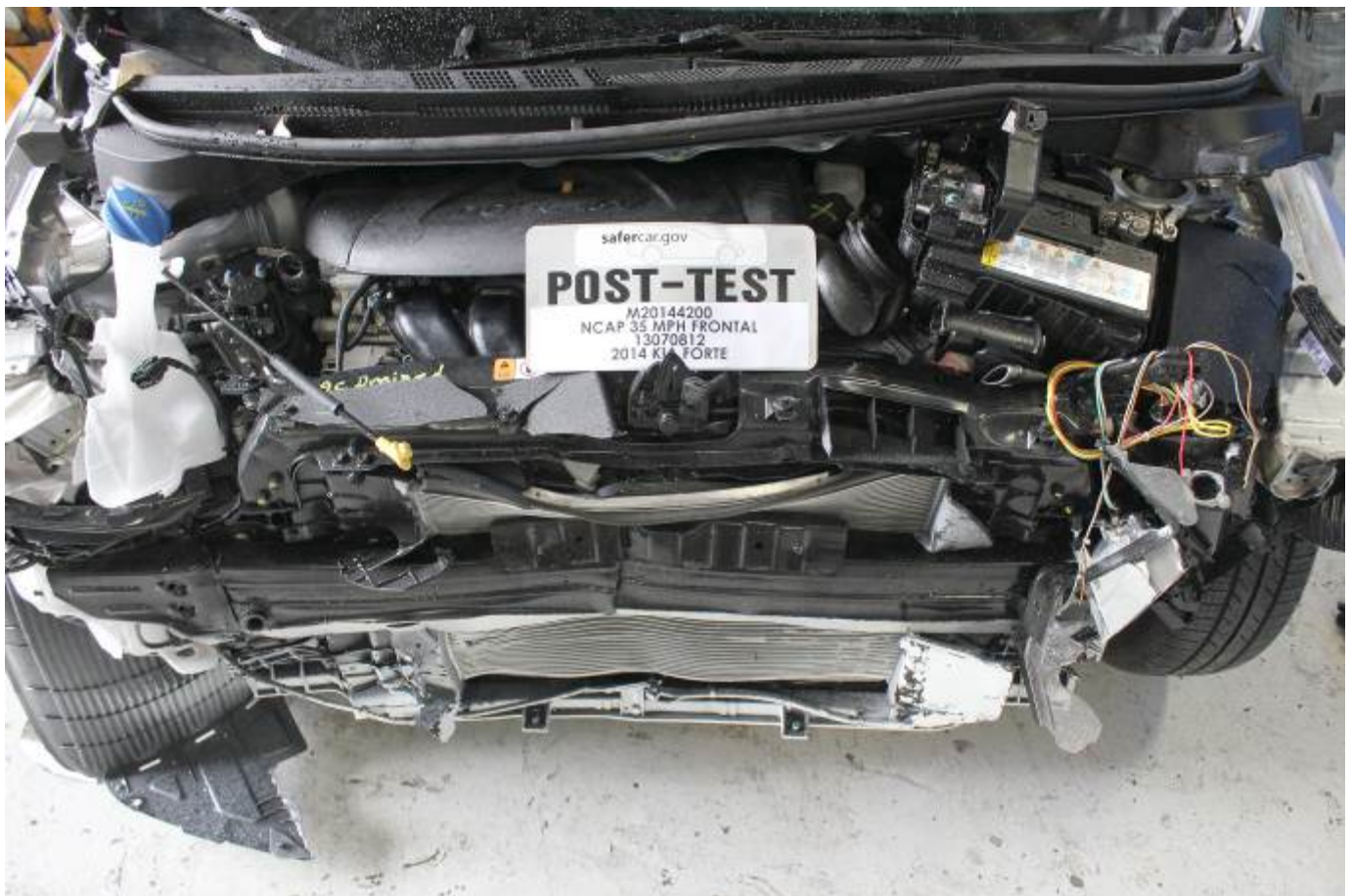
Pre-Test Windshield View



Post-Test Windshield View



Pre-Test Engine Compartment View



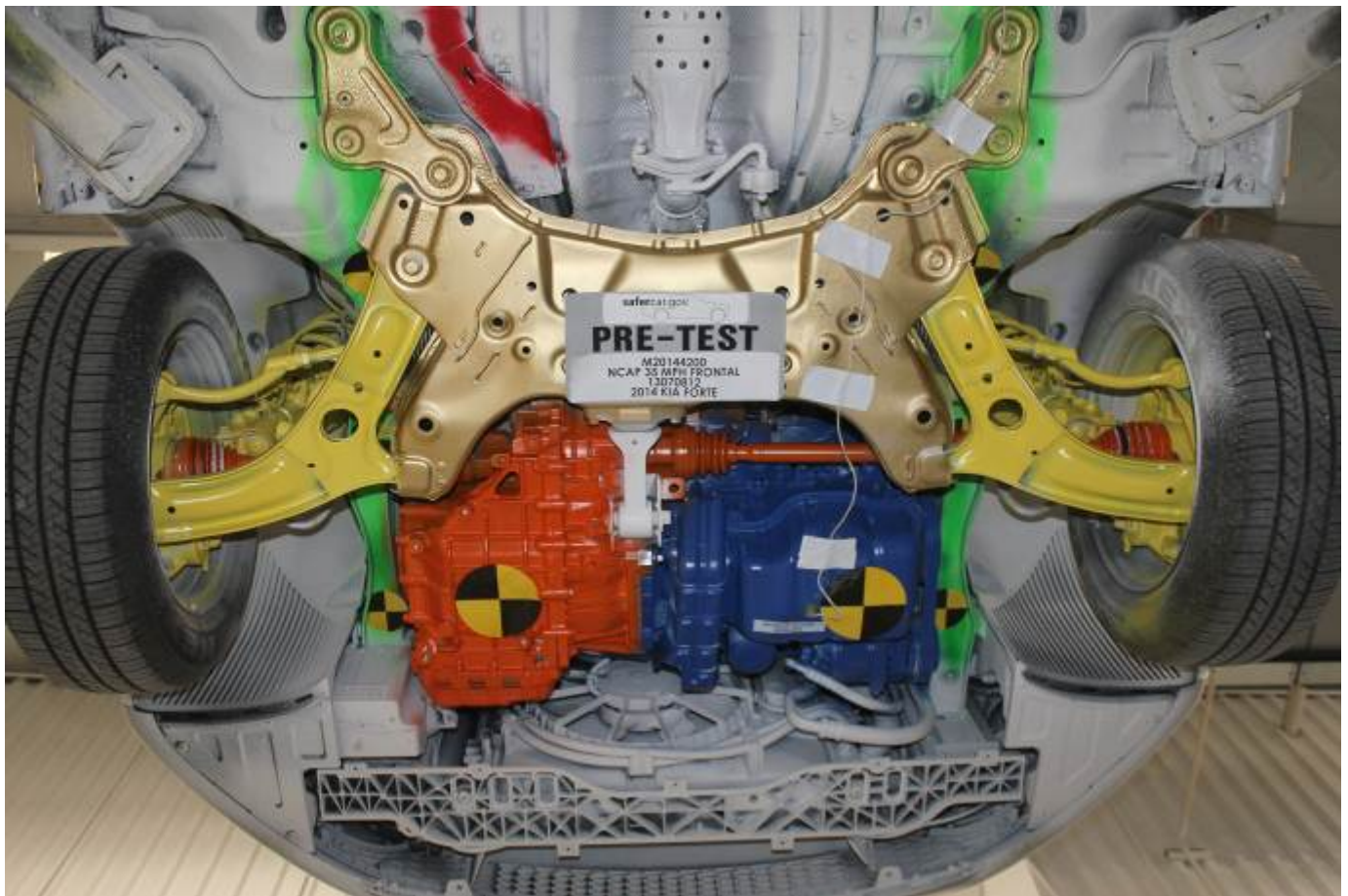
Post-Test Engine Compartment View



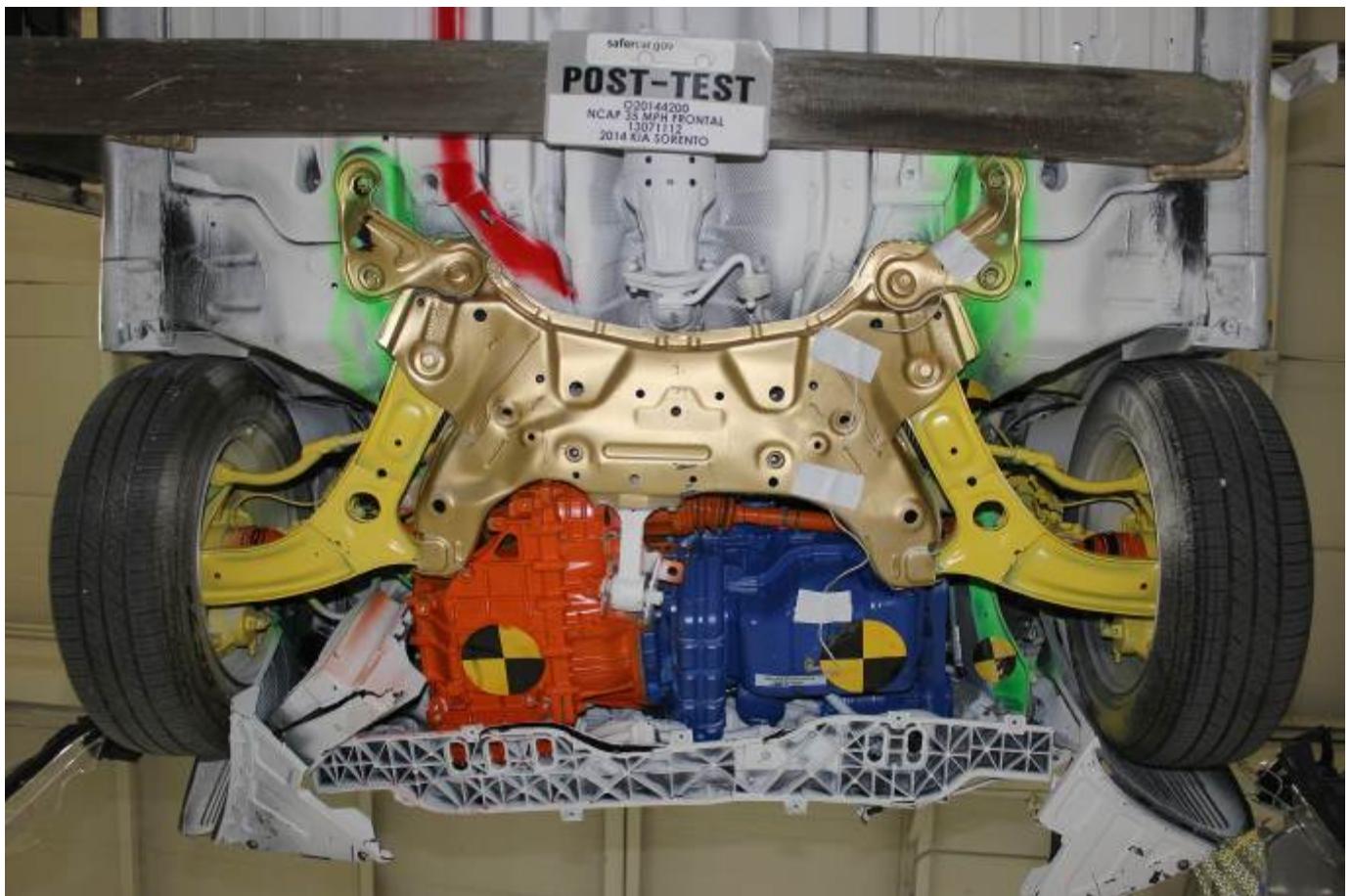
Pre-Test Fuel Filler Cap View



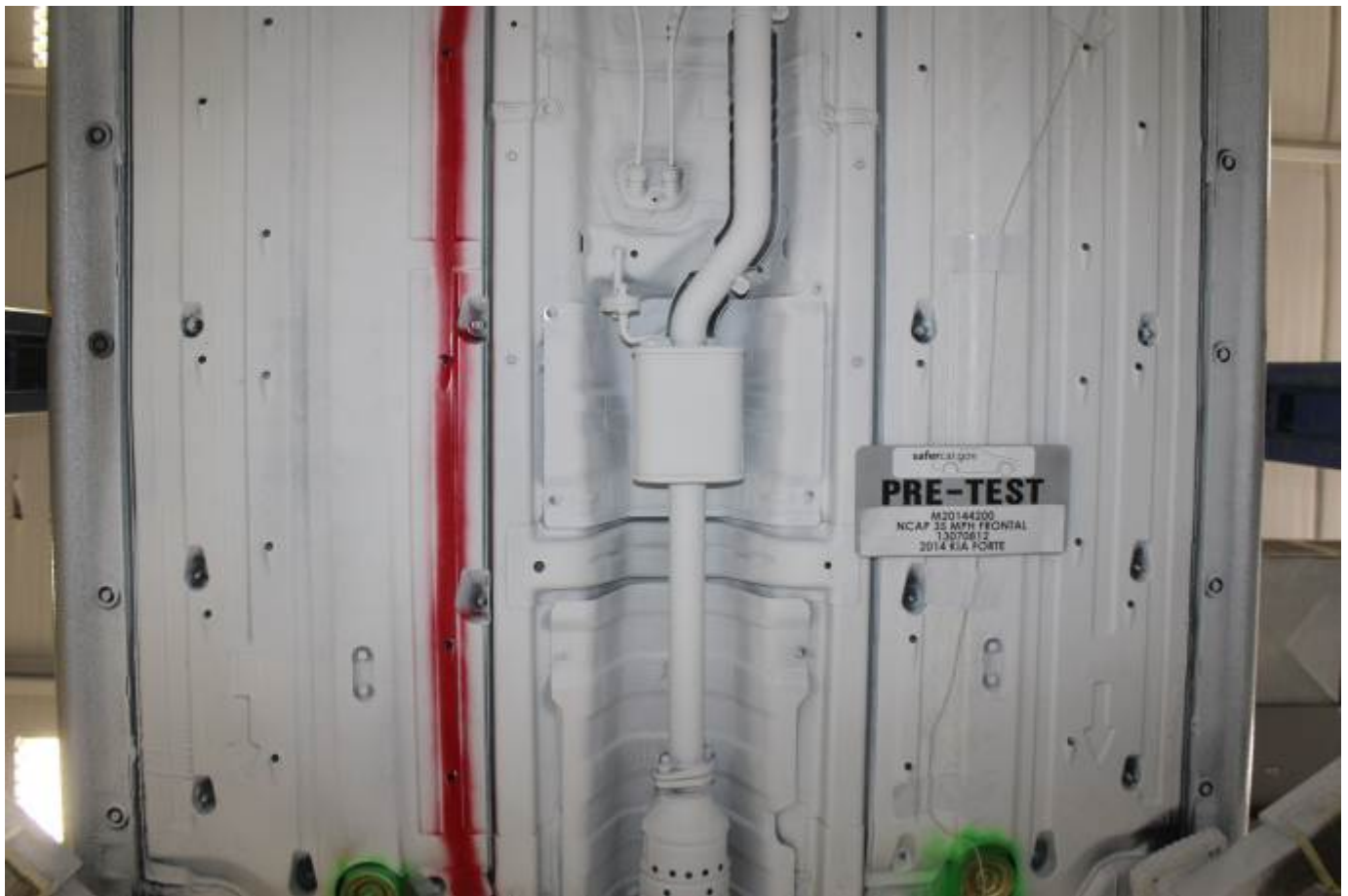
Post-Test Fuel Filler Cap View



Pre-Test Front Underbody View



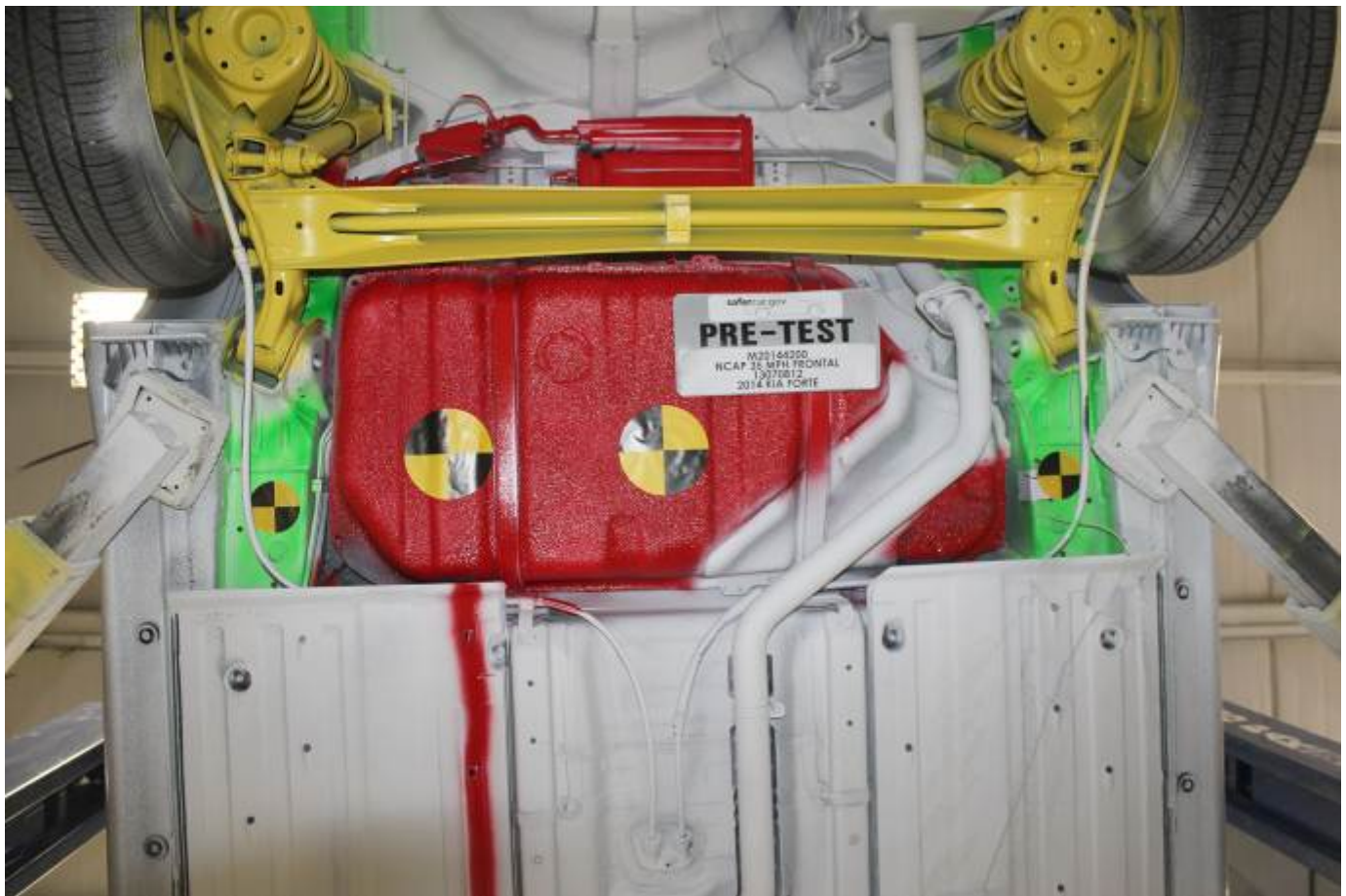
Post-Test Front Underbody View



Pre-Test Mid Front Underbody View



Post-Test Mid Front Underbody View



Pre-Test Mid Rear Underbody View



Post-Test Mid Rear Underbody View



Pre-Test Rear Underbody View



Post-Test Rear Underbody View



Pre-Test Dummy Cable Routing



Post-Test Dummy Cable Routing



Pre-Test Driver Dummy Front View



Post-Test Driver Dummy Front View



Pre-Test Driver Dummy Window View



Post-Test Driver Dummy Window View



Pre-Test Driver Dummy and Vehicle Interior (Door Open)



Post-Test Driver Dummy and Vehicle Interior (Door Open)



Pre-Test Driver's Seat Fore-Aft Markings



Post-Test Driver's Seat Fore-Aft Markings



Pre-Test View of Belt Anchorage for Driver Dummy



Post-Test View of Belt Anchorage for Driver Dummy



Pre-Test Driver Dummy Feet



Post-Test Driver Dummy Feet



Pre-Test Driver's Side Knee Bolster (without dummy)



Post-Test Driver's Side Knee Bolster (without dummy)



Pre-Test Driver's Side Floorpan



Post-Test Driver's Side Floorpan



Post-Test Driver Dummy Face



Post-Test Driver Dummy Contact with Airbag



Post-Test Driver Dummy Contact with Headrest



Post-Test Driver Dummy Contact with Knee Bolster



Pre-Test View of the Steering Wheel



Post-Test View of the Steering Wheel



Pre-Test Passenger Dummy Front View



Post-Test Passenger Dummy Front View



Pre-Test Passenger Dummy Window View



Post-Test Passenger Dummy Window View



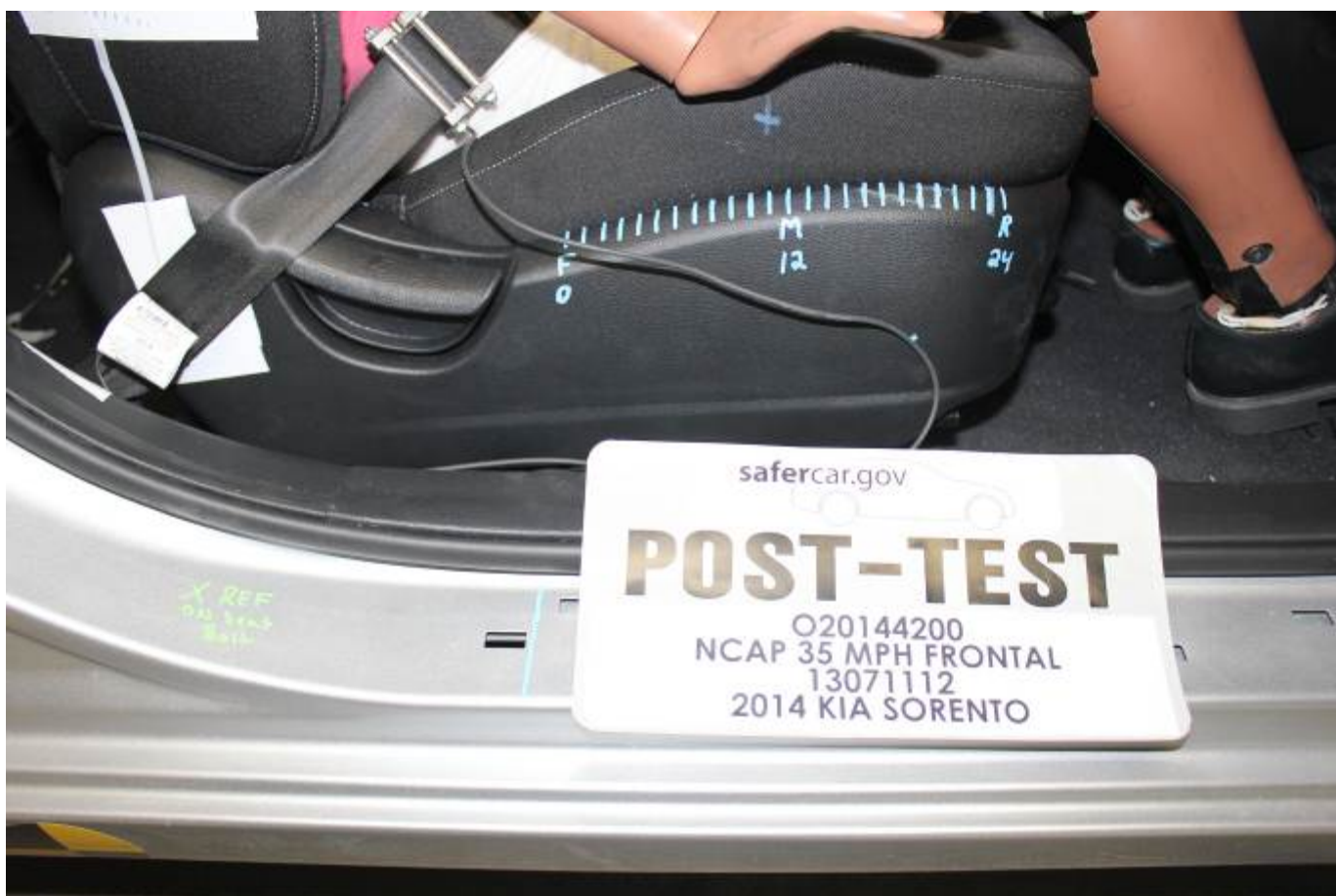
Pre-Test Passenger Dummy and Vehicle Interior (Door Open)



Post-Test Passenger Dummy and Vehicle Interior (Door Open)



Pre-Test Passenger's Seat Fore-Aft Markings



Post-Test Passenger's Seat Fore-Aft Markings



Pre-Test View of Belt Anchorage for Passenger Dummy



Post-Test View of Belt Anchorage for Passenger Dummy



Pre-Test Passenger Dummy Feet



Post-Test Passenger Dummy Feet



Pre-Test Passenger's Side Knee Bolster (without dummy)



Post-Test Passenger's Side Knee Bolster (without dummy)



Pre-Test Passenger's Side Floorpan



Post-Test Passenger's Side Floorpan



Post-Test Passenger Dummy Contact with Airbag



Post-Test Passenger Dummy Contact with Headrest



Post-Test Passenger Dummy Contact with Glove Box



Ballast Installed in Vehicle

PHOTOGRAPH NOT APPLICABLE

Post-Test Stoddard Solvent Spillage Location View



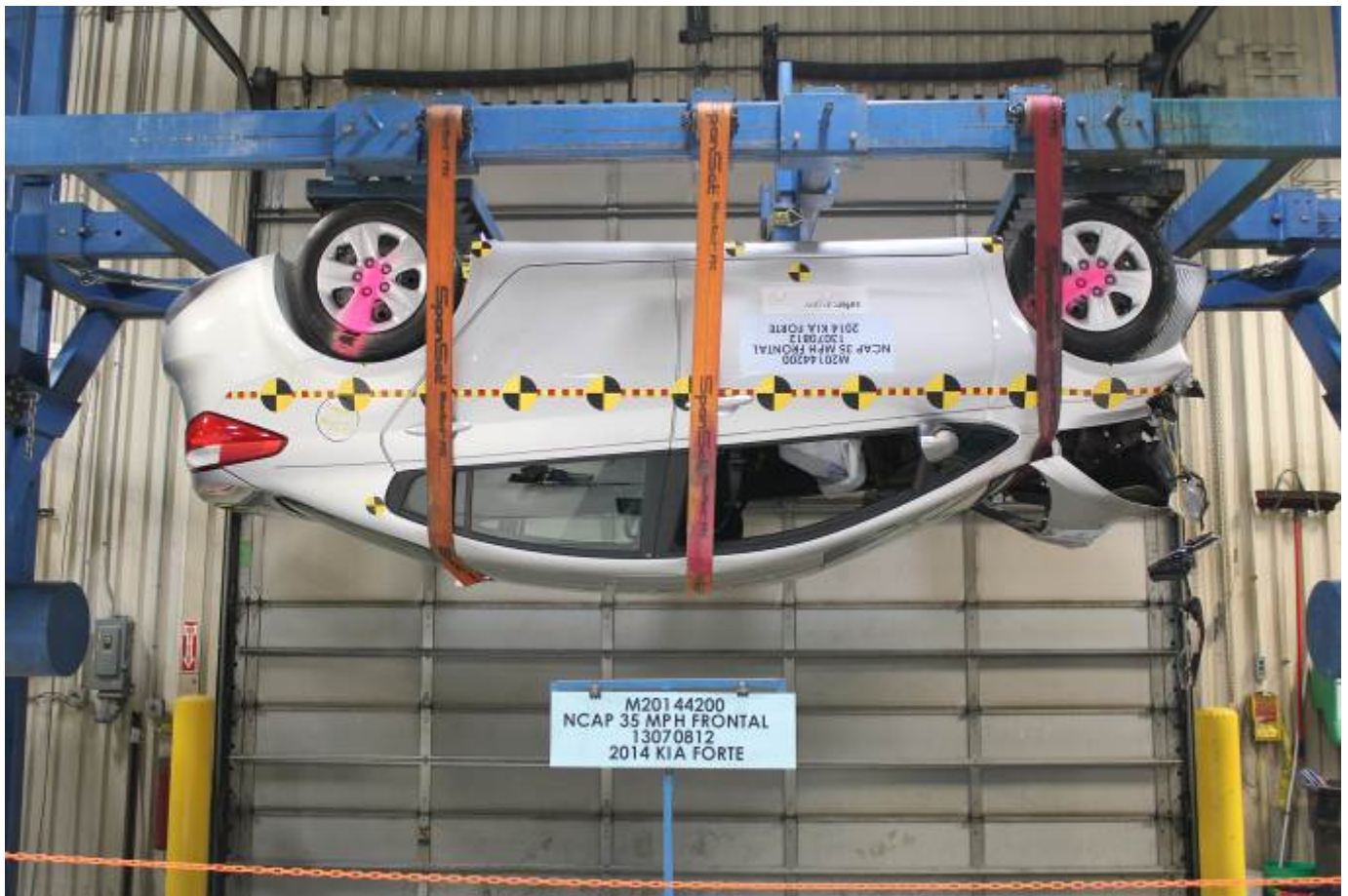
Post-Test Speed Trap Read-Out



Vehicle at 0° on Static Rollover Device



Vehicle at 90° on Static Rollover Device



Vehicle at 180° on Static Rollover Device



Vehicle at 270° on Static Rollover Device



Vehicle at 360° on Static Rollover Device



2014 KIA Forte Frontal Impact Event

2014 KIA FORTE LX MODEL / OPTION CODE: C3422 / 020 EXTERIOR / INTERIOR: BRIGHT SILVER/BLK VEHICLE ID NUMBER: KNAFK4ABX65085071 ENGINE NUMBER: G1N8D000 POINT OF ENTRY: TACOMA MODE OF TRANSPORT: TRUCK	SOLD TO: W0028 METRO KIA OF MADISON 5422 WAYNE TERRACE MADISON WI 53718 SHIP TO: W0028	kia.com 												
STANDARD FEATURES MECHANICAL 1.8L DOHC D-CVVT 4-Cylinder Engine 6-Speed Automatic Transmission w/ Sportomatic Front and Rear Disc Brakes SAFETY Dual Front Advanced Airbags Front Seat-Mounted Side Airbags Full-Length Side Curtain Airbags Lower Anchors and Tethers for Children (LATCH) Anti-Lock Braking System (ABS) w/ Brake Assist (BAS) Traction Control System (TCS) Electronic Stability Control (ESC) Vehicle Stability Management (VSM) Hill-start Assist Control (HAC) Tire Pressure Monitoring System (TPMS) INTERIOR Air Conditioning Power Windows and Door Locks AM/FM/CD/MP3 Audio System SIRIUS/XM Satellite Radio w/free 3-mo. subscription* USB/Auxiliary Input Jacks BLUETOOTH® WIRELESS TECHNOLOGY Multi-Adjustable Driver's Seat 60/40 Split Folding Rear Seats Tilt & Telescopic Steering Column Steering Wheel Mounted Audio Controls Center Console w/ Armrest EXTERIOR Power Heated Outside Mirrors Variable Intermittent Front Windshield Wipers 5-spoke Bumpers WARRANTY 10 Year/100,000 Mile Limited Powertrain Warranty 5 Year/60,000 Mile Limited Basic Warranty 5 Year/60,000 Mile Roadside Assistance *Ask dealer for details	MANUFACTURER'S SUGGESTED RETAIL PRICE → \$17,400.00 ADDITIONAL INSTALLED EQUIPMENT: (in addition to or in place of standard features) Rear Bumper Applique \$75.00 Carpeted Floor Mats \$115.00 MSRP INCLUDING OPTIONS \$17,590.00 INLAND FREIGHT AND HANDLING \$800.00 TOTAL MANUFACTURER'S SUGGESTED RETAIL PRICE → \$18,390.00	EPA DOT Fuel Economy and Environment Fuel Economy 29 MPG combined city/hwy 25 MPG city 36 MPG highway 3.4 gallons per 100 miles Annual fuel cost \$1800 Fuel Economy & Greenhouse Gas Rating (passenger only) 7 (Best) / 5 (Worst) GOVERNMENT 5-STAR SAFETY RATINGS Overall Vehicle Score Not Rated Based on the combined ratings of frontal, side and rollover. Should ONLY be compared to other vehicles of similar size and weight. <table border="1"> <tr> <td>Frontal Crash</td> <td>Driver Passenger</td> <td>Not Rated</td> </tr> <tr> <td>Side Crash</td> <td>Front seat</td> <td>Not Rated</td> </tr> <tr> <td></td> <td>Rear seat</td> <td>Not Rated</td> </tr> <tr> <td>Rollover</td> <td></td> <td>Not Rated</td> </tr> </table> PARTS CONTENT INFORMATION FOR VEHICLES IN THIS CAR LINE U.S./CANADIAN PARTS CONTENT: 1% MAJOR SOURCES OF FOREIGN PARTS: KOREA: 95% FOR THIS VEHICLE FINAL ASSEMBLY POINT: KOREA COUNTRY OF ORIGIN ENGINE: KOREA TRANSMISSION: KOREA	Frontal Crash	Driver Passenger	Not Rated	Side Crash	Front seat	Not Rated		Rear seat	Not Rated	Rollover		Not Rated
Frontal Crash	Driver Passenger	Not Rated												
Side Crash	Front seat	Not Rated												
	Rear seat	Not Rated												
Rollover		Not Rated												

Monroney Label

APPENDIX B
DUMMY RESPONSE DATA TRACES

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The following additional dummy and vehicle response data can be found in the R&D section of the NHTSA website at www.nhtsa.dot.gov

Driver Head CG X Redundant
 Driver Head CG Y Redundant
 Driver Head CG Z Redundant
 Driver 9 Axis Head X Arm Y
 Driver 9 Axis Head X Arm Z
 Driver 9 Axis Head Y Arm X
 Driver 9 Axis Head Y Arm Z
 Driver 9 Axis Head Z Arm X
 Driver 9 Axis Head Z Arm Y
 Driver Upper Neck Force Y
 Driver Upper Neck Moment X
 Driver Upper Neck Moment Z
 Driver Chest X Redundant
 Driver Chest Y Redundant
 Driver Chest Z Redundant
 Driver Pelvis X
 Driver Pelvis Y
 Driver Pelvis Z
 Driver Left Femur Redundant
 Driver Right Femur Redundant

Driver Left Upper Tibia Moment X
Driver Left Upper Tibia Moment Y
Driver Left Upper Tibia Force Z
Driver Left Lower Tibia Moment X
Driver Left Lower Tibia Moment Y
Driver Left Lower Tibia Force Z
Driver Right Upper Tibia Moment X
Driver Right Upper Tibia Moment Y
Driver Right Upper Tibia Force Z
Driver Right Lower Tibia Moment X
Driver Right Lower Tibia Moment Y
Driver Right Lower Tibia Force Z
Driver Left Foot Fore Z
Driver Left Foot Aft X
Driver Left Foot Aft Z
Driver Right Foot Fore Z
Driver Right Foot Aft X
Driver Right Foot Aft Z
Driver Lap Belt Force
Driver Shoulder Belt Force
Passenger Head X Redundant
Passenger Head Y Redundant
Passenger Head Z Redundant
Passenger Upper Neck Force Y
Passenger Upper Neck Moment X
Passenger Upper Neck Moment Z
Passenger Chest X Redundant
Passenger Chest Y Redundant
Passenger Chest Z Redundant
Passenger Pelvis X
Passenger Pelvis Y
Passenger Pelvis Z

Passenger Left Femur Redundant
Passenger Right Femur Redundant
Passenger Left Upper Tibia Moment X
Passenger Left Upper Tibia Moment Y
Passenger Left Upper Tibia Force Z
Passenger Left Lower Tibia Moment X
Passenger Left Lower Tibia Moment Y
Passenger Left Lower Tibia Force Z
Passenger Right Upper Tibia Moment X
Passenger Right Upper Tibia Moment Y
Passenger Right Upper Tibia Force Z
Passenger Right Lower Tibia Moment X
Passenger Right Lower Tibia Moment Y
Passenger Right Lower Tibia Force Z
Passenger Left Foot Fore Z
Passenger Left Foot Aft X
Passenger Left Foot Aft Z
Passenger Right Foot Fore Z
Passenger Right Foot Aft X
Passenger Right Foot Aft Z
Passenger Lap Belt Force
Passenger Shoulder Belt Force
Passenger Head X Redundant
Passenger Head Y Redundant
Passenger Head Z Redundant
Passenger Upper Neck Force Y
Passenger Upper Neck Moment X
Passenger Upper Neck Moment Z
Left Rear Seat Crossmember X
Right Rear Seat Crossmember X
Vehicle Engine Top X
Vehicle Engine Bottom X

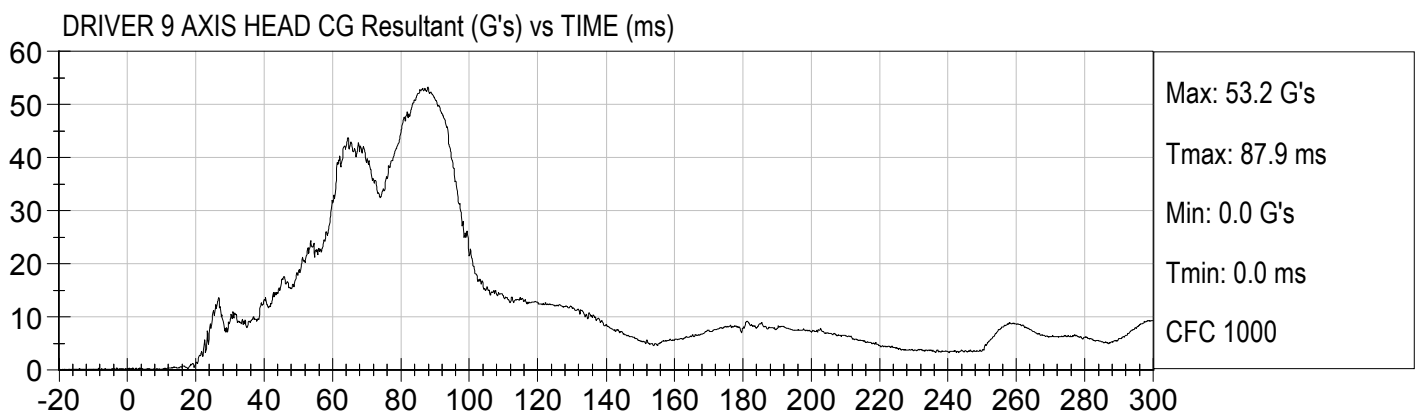
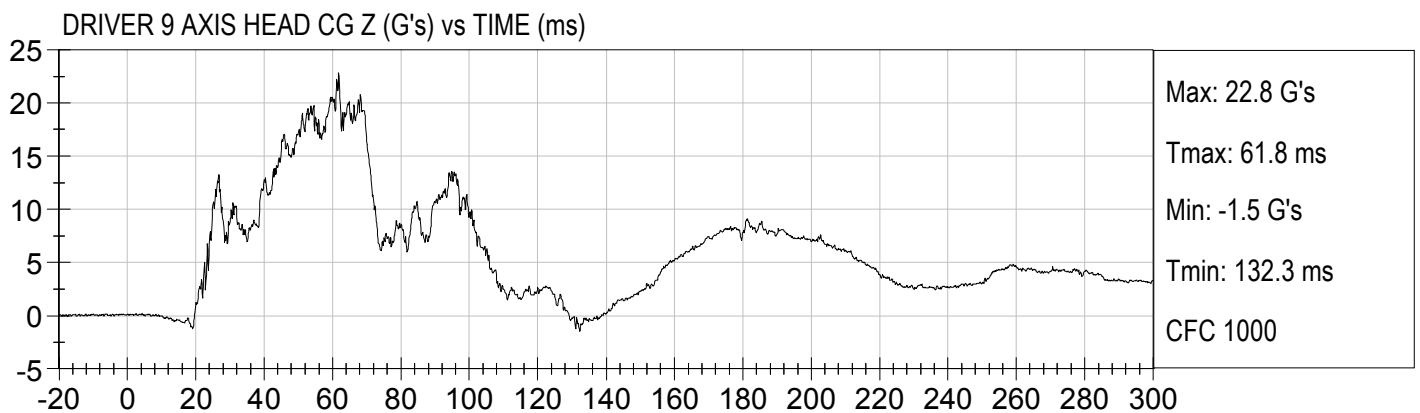
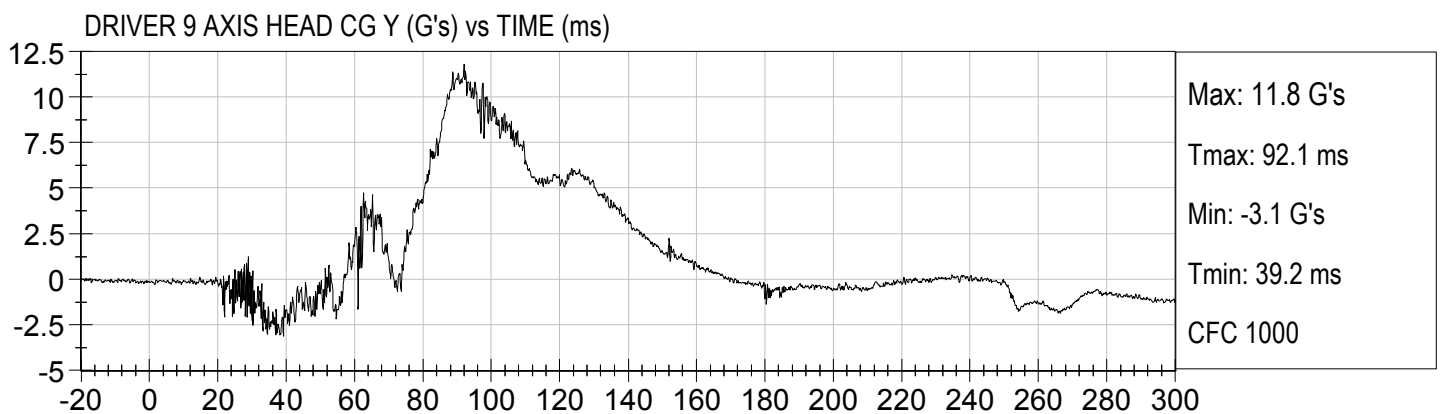
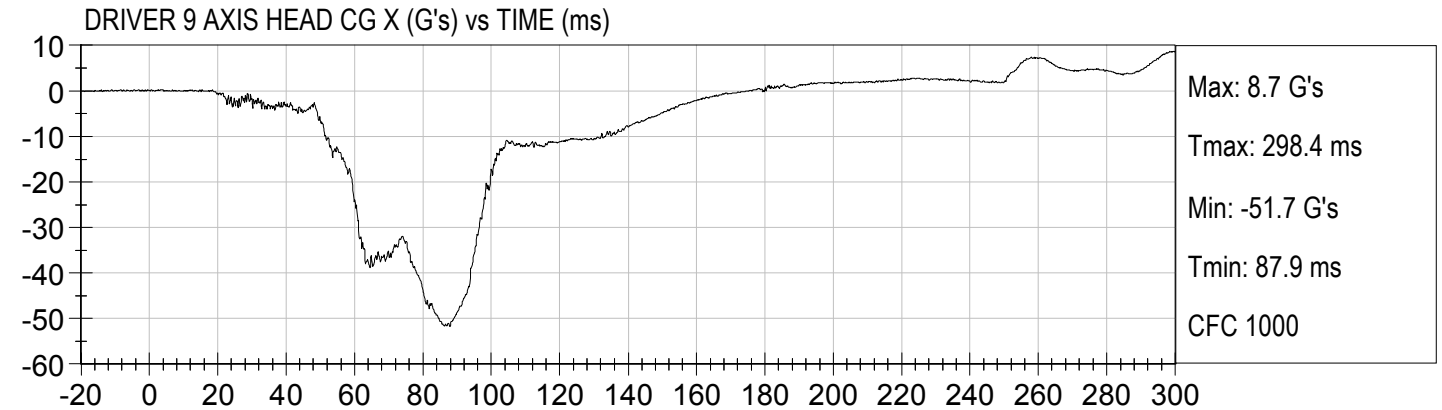
Left Rear Seat Crossmember Z

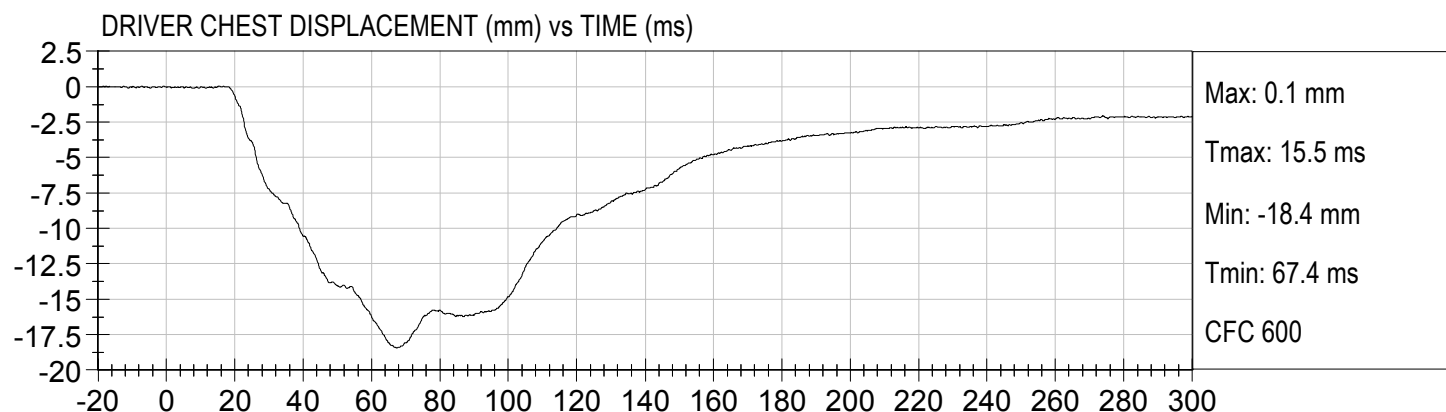
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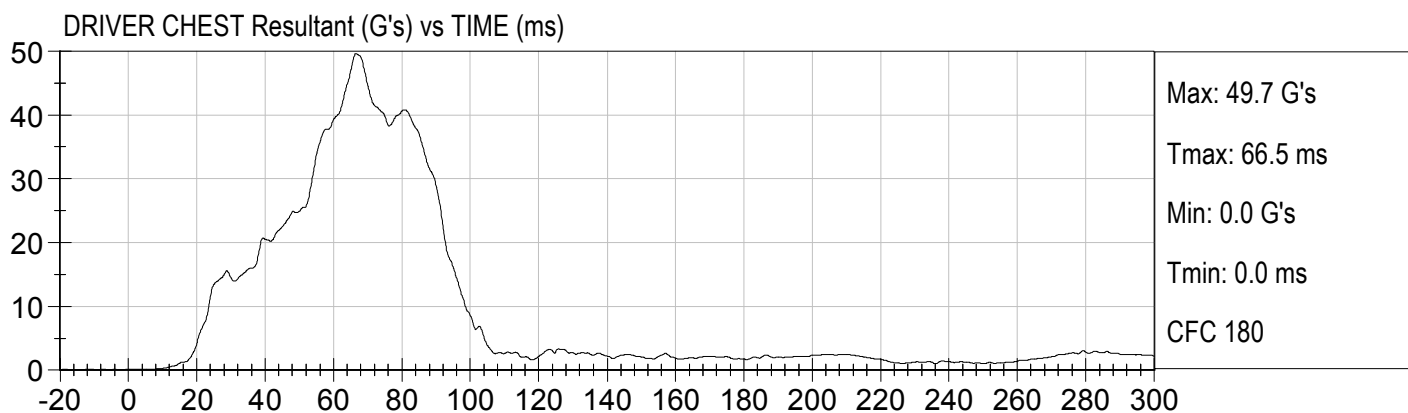
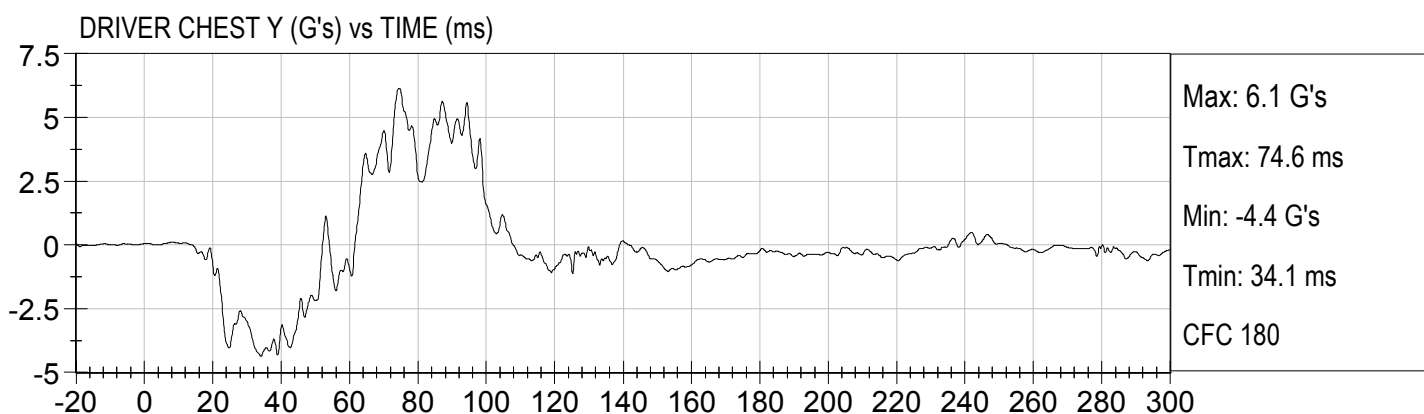
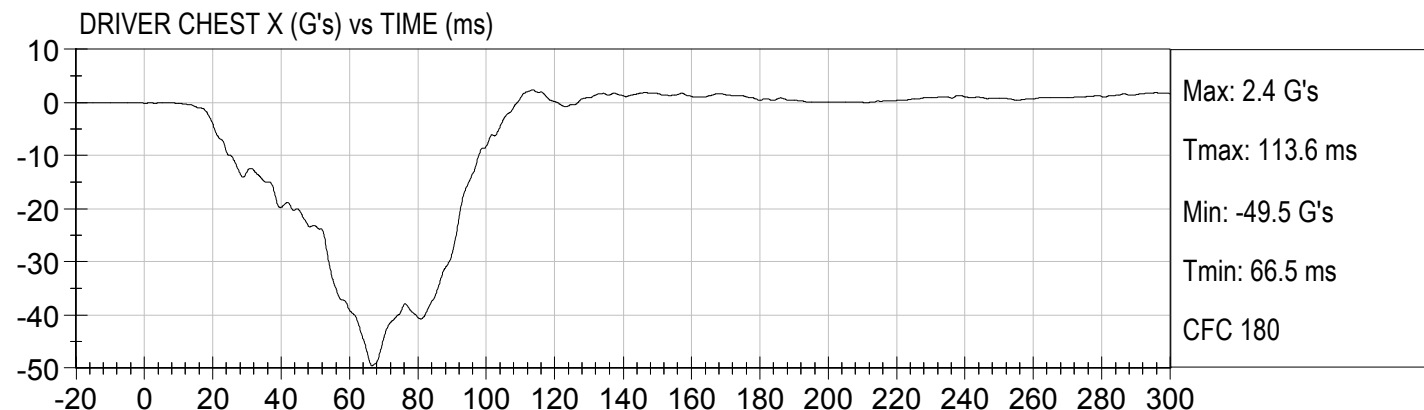
Left Rear Seat Crossmember Xr

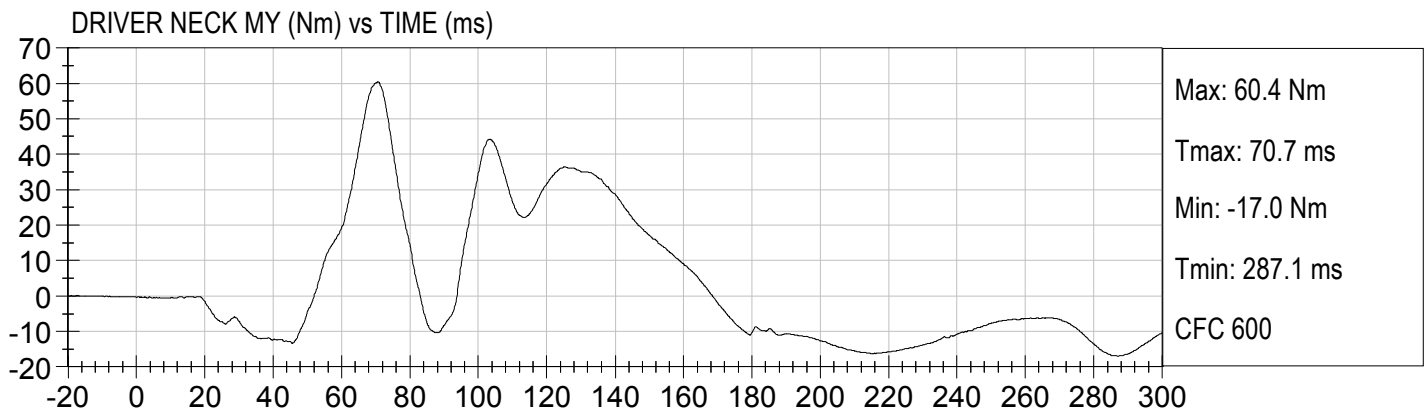
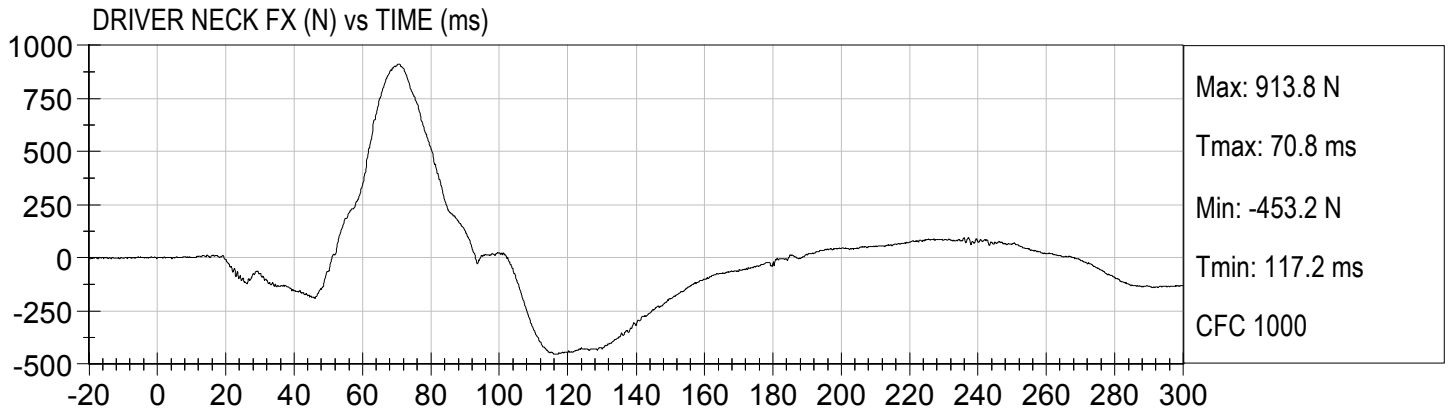
Right Rear Seat Crossmember Xr

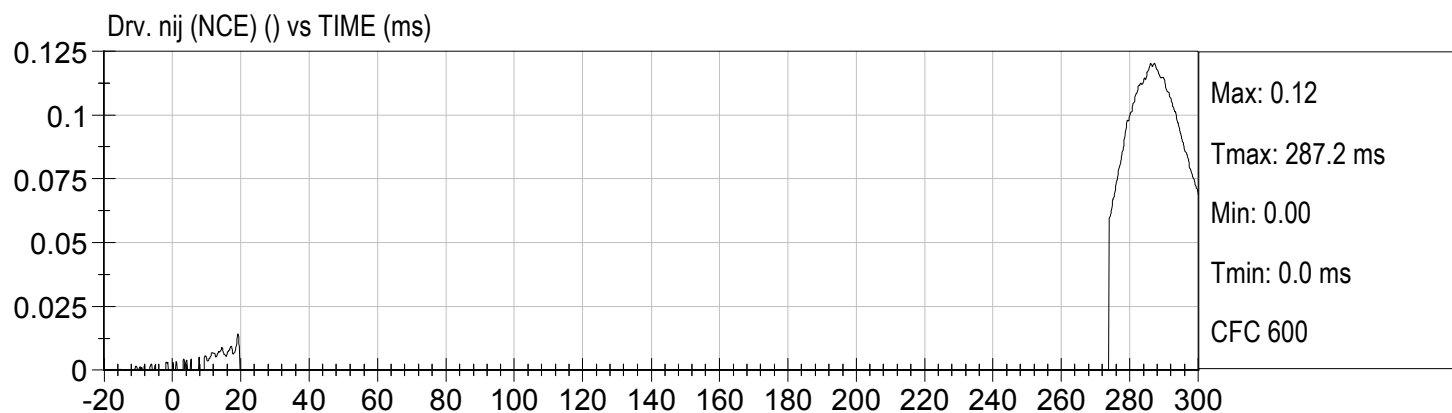
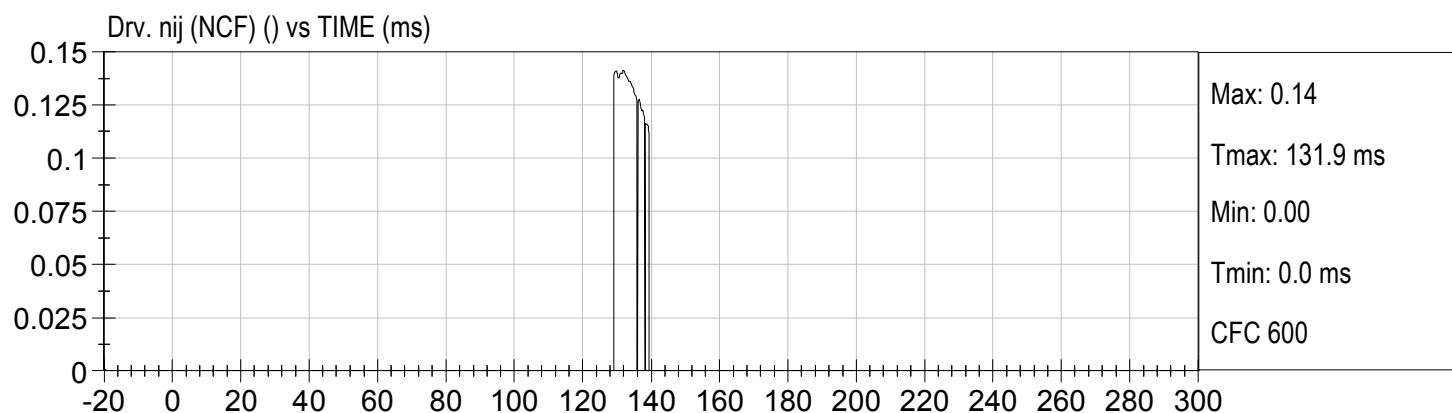
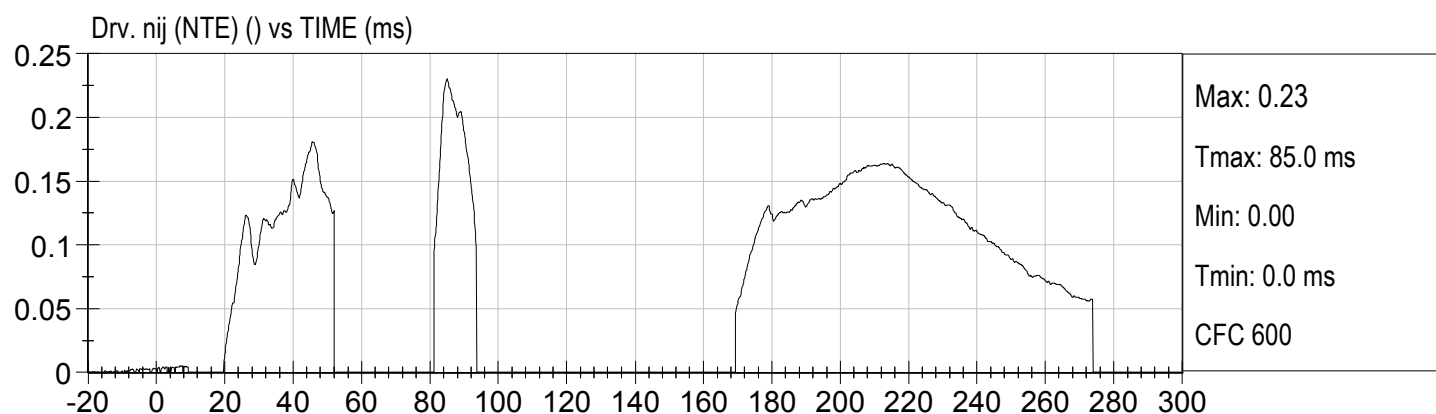
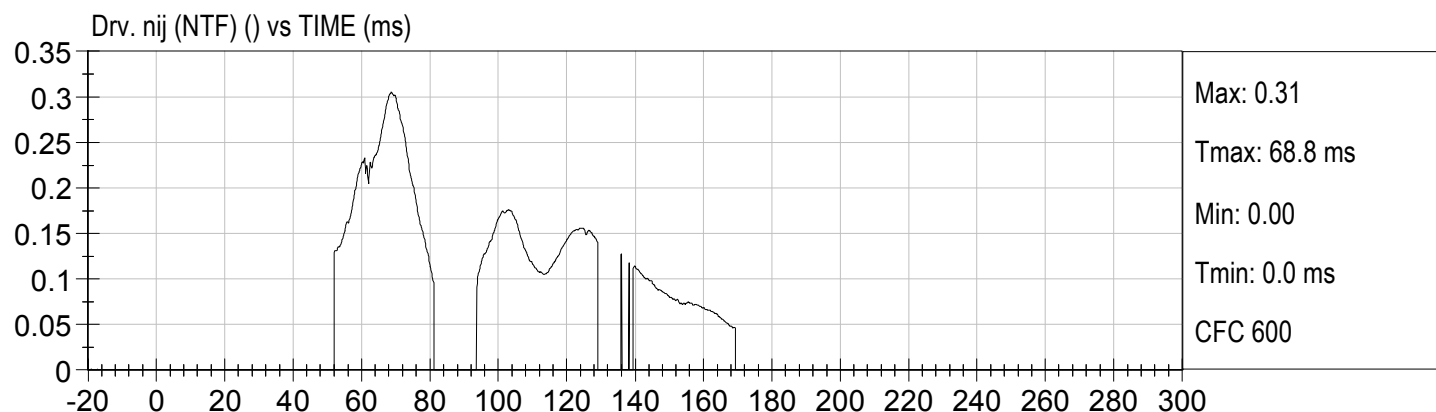
Advanced Research Load Cell Barrier – 528 channels





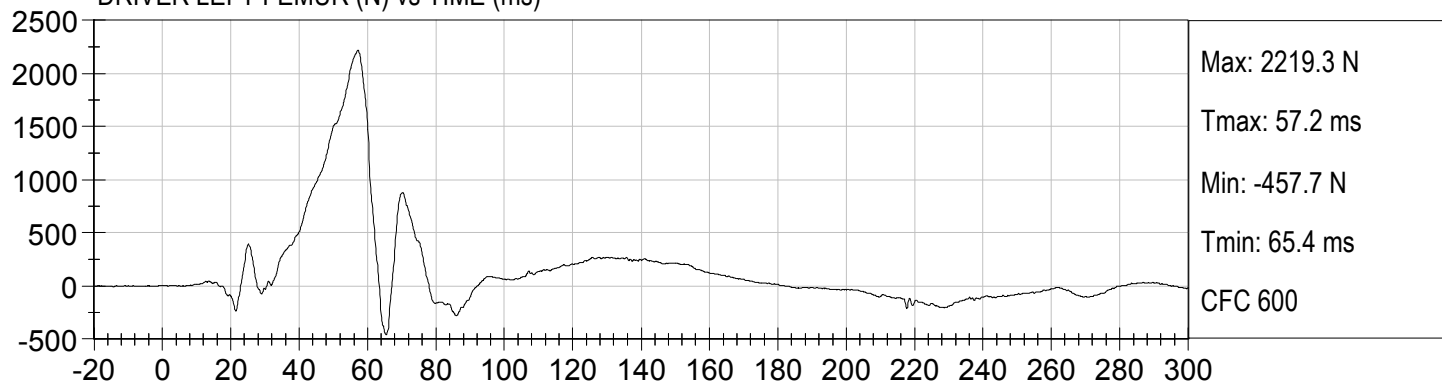




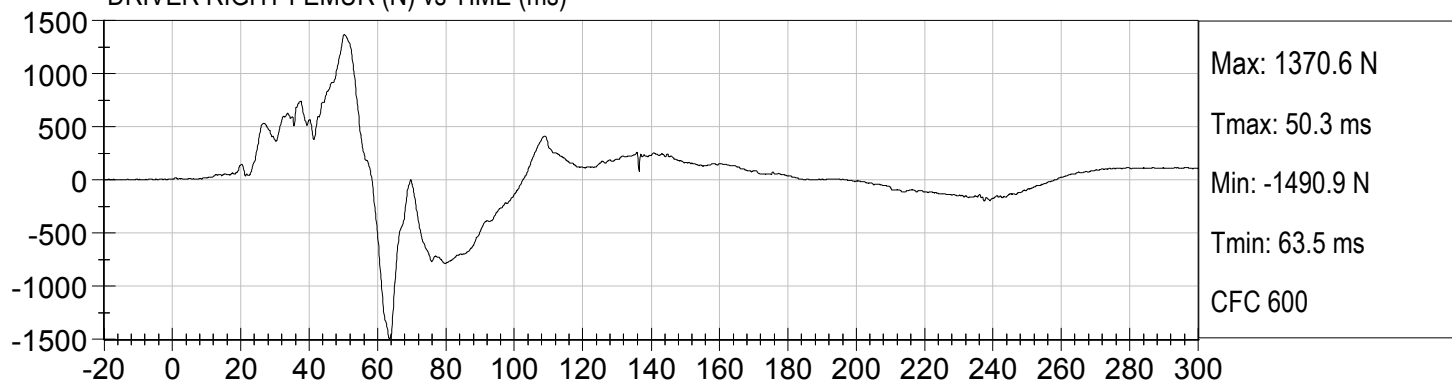


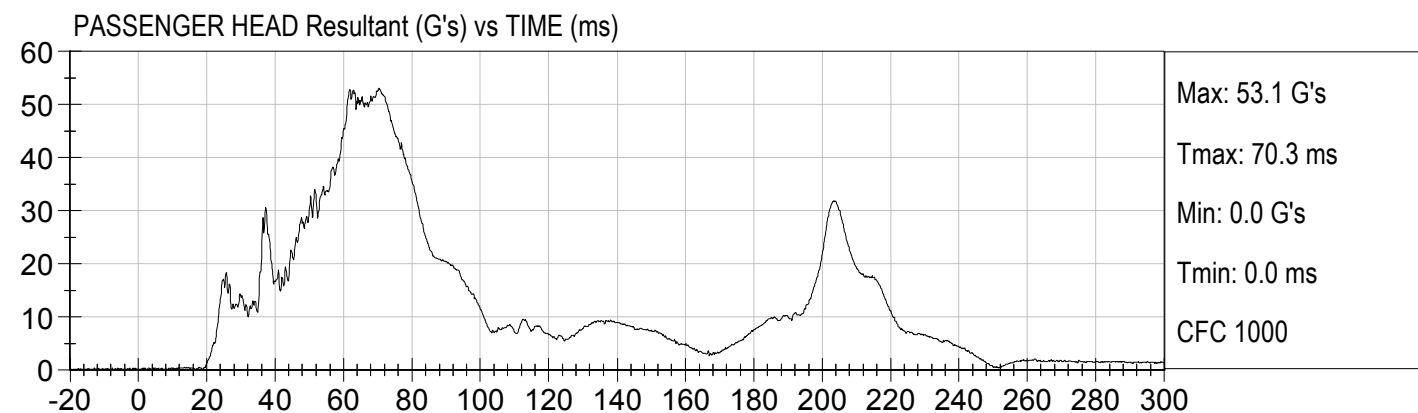
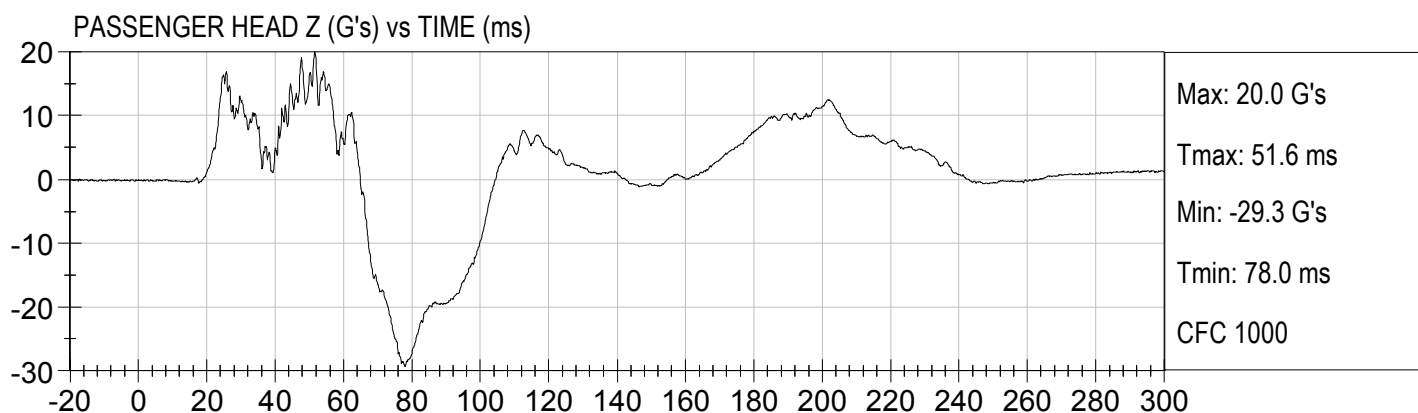
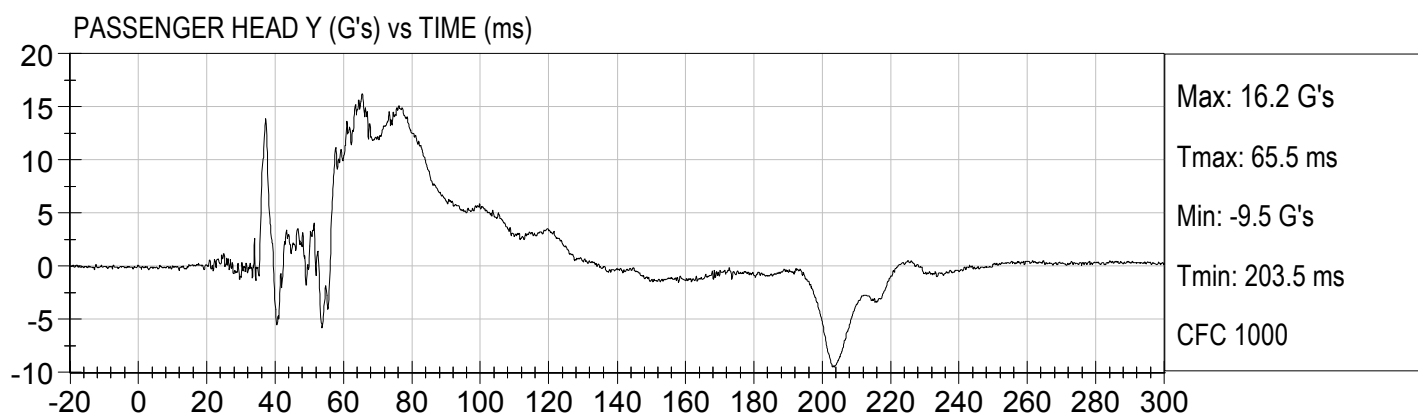
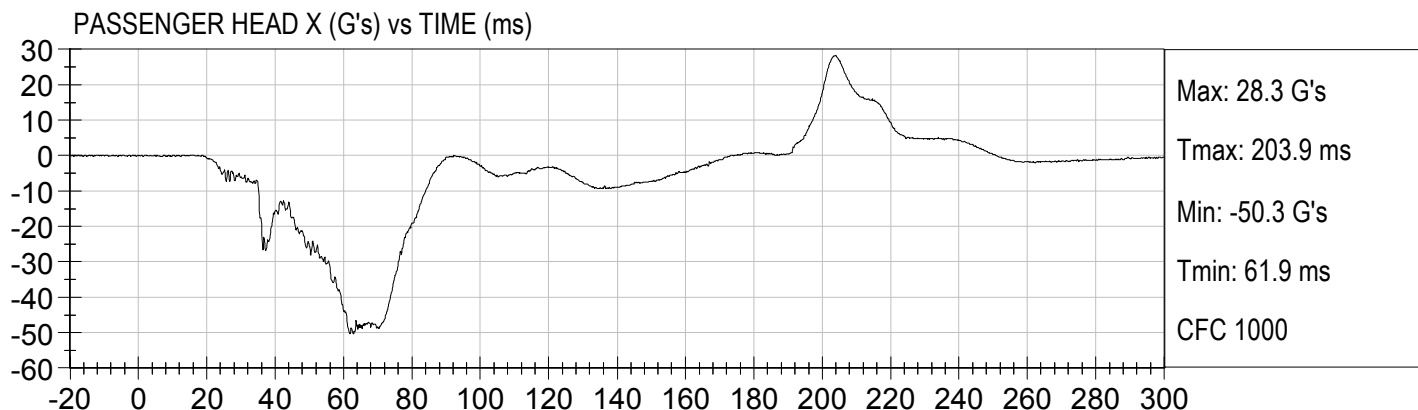


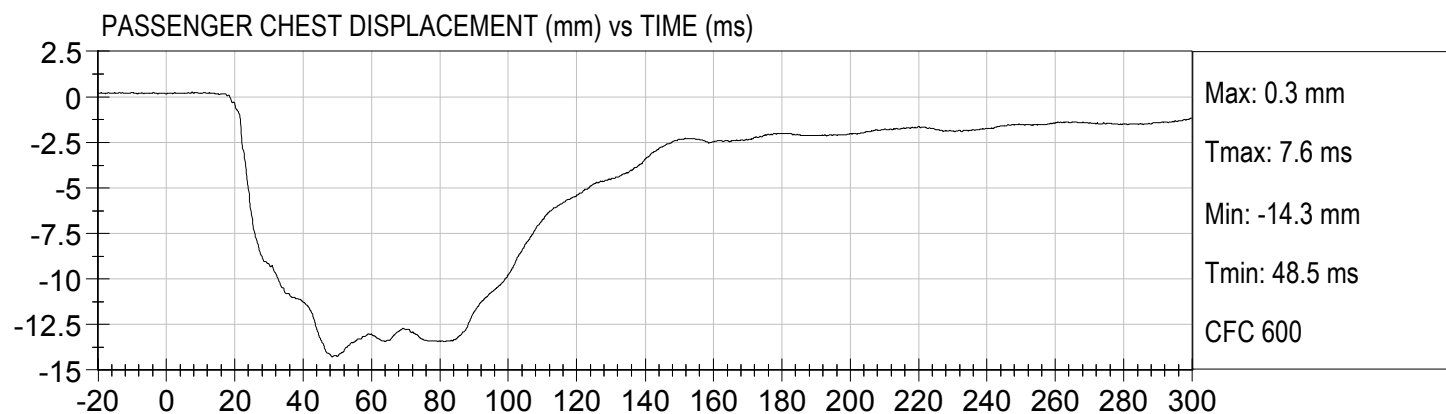
DRIVER LEFT FEMUR (N) vs TIME (ms)

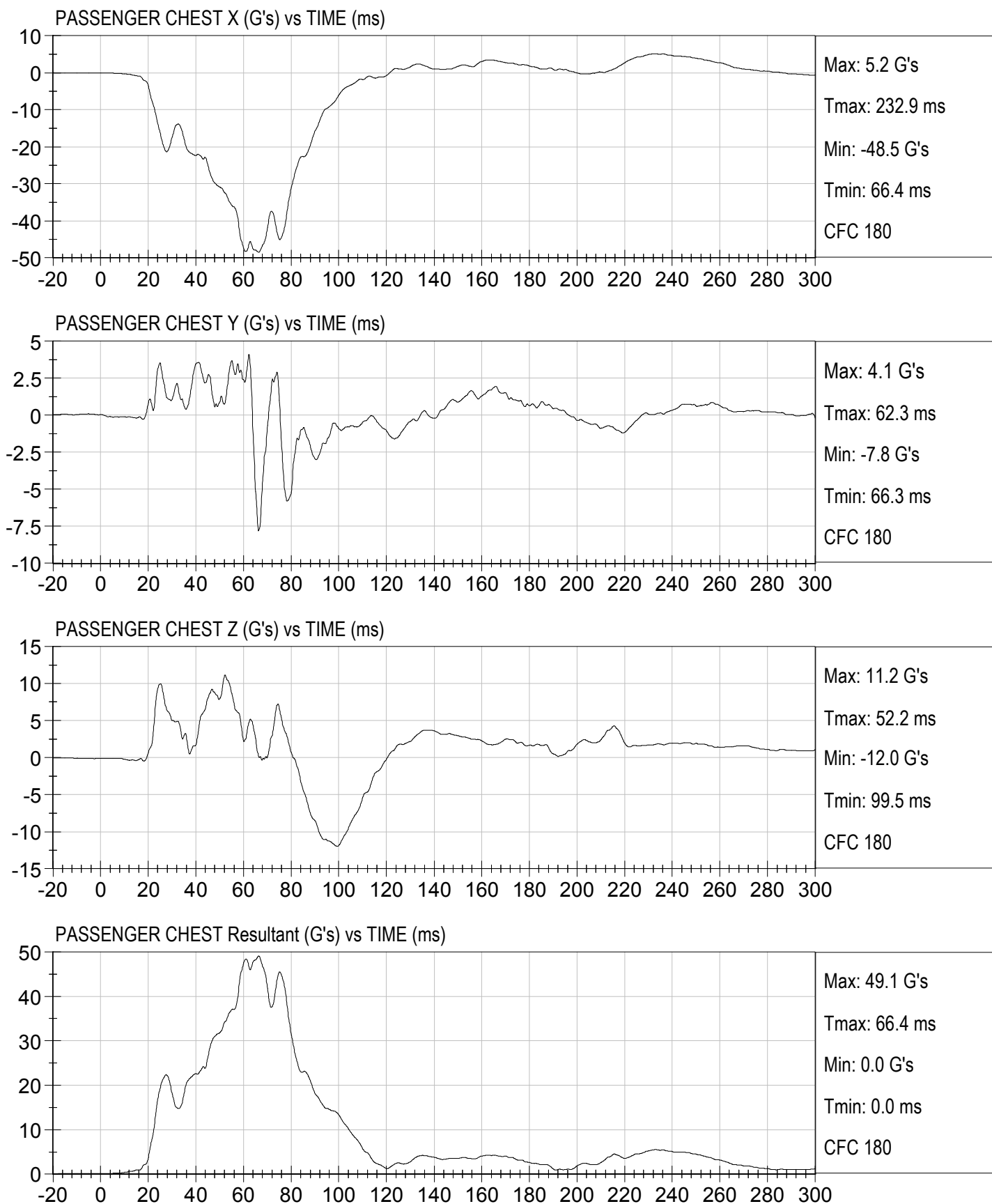


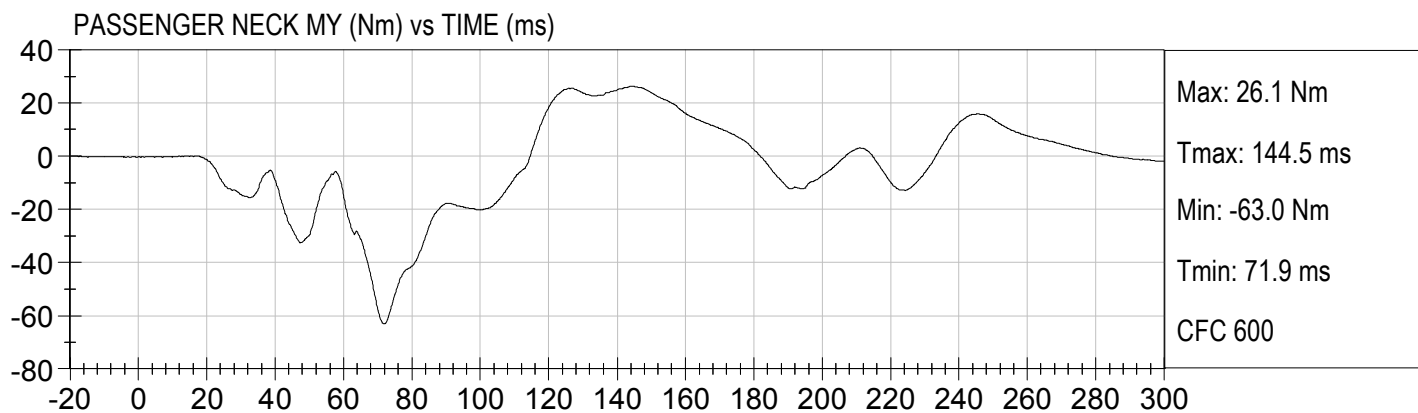
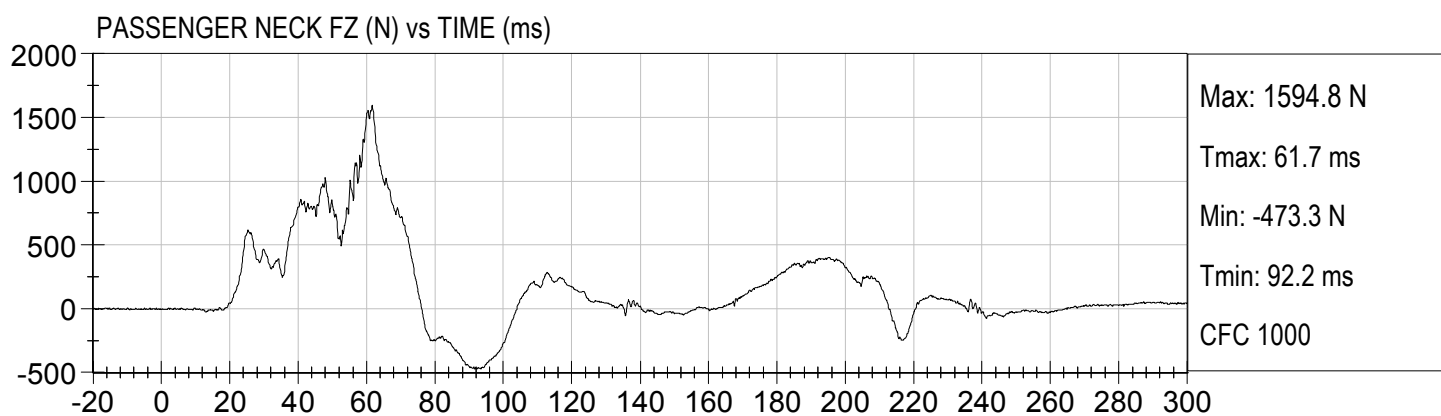
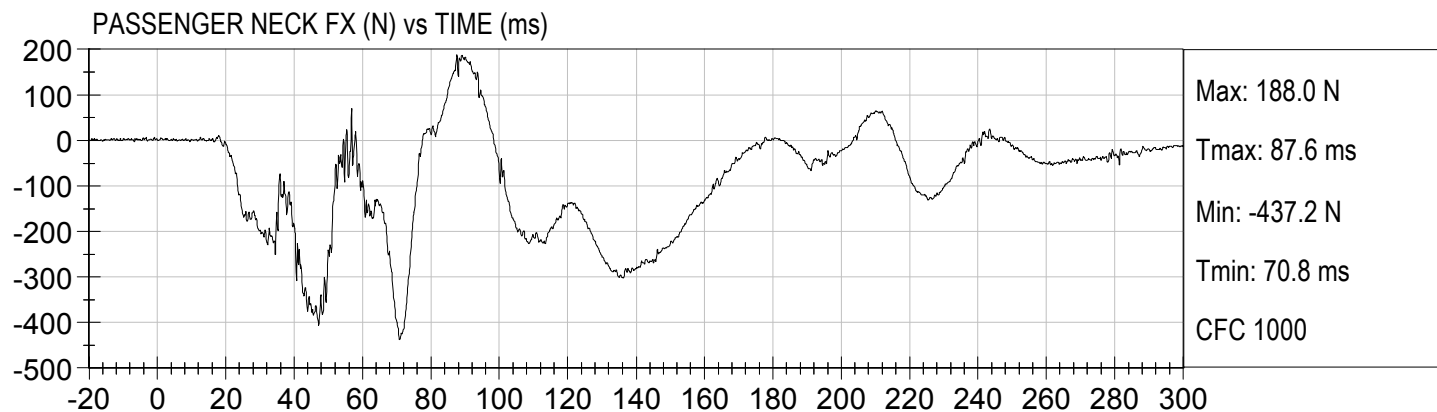
DRIVER RIGHT FEMUR (N) vs TIME (ms)

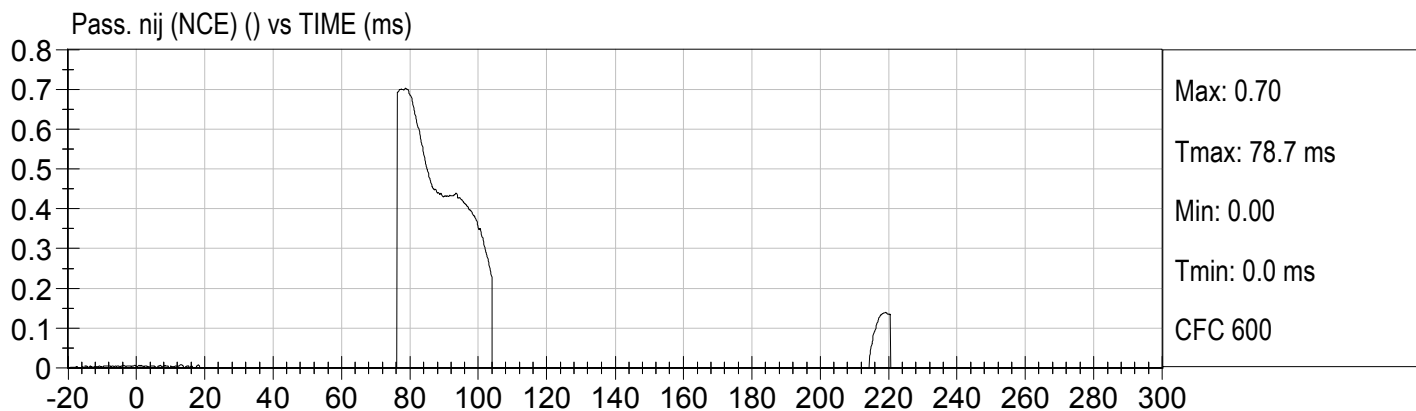
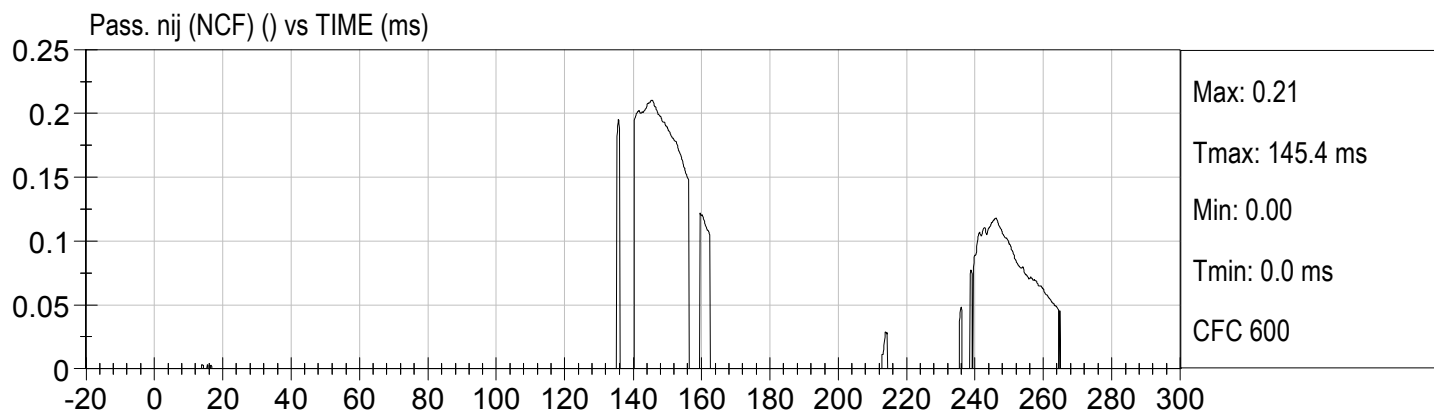
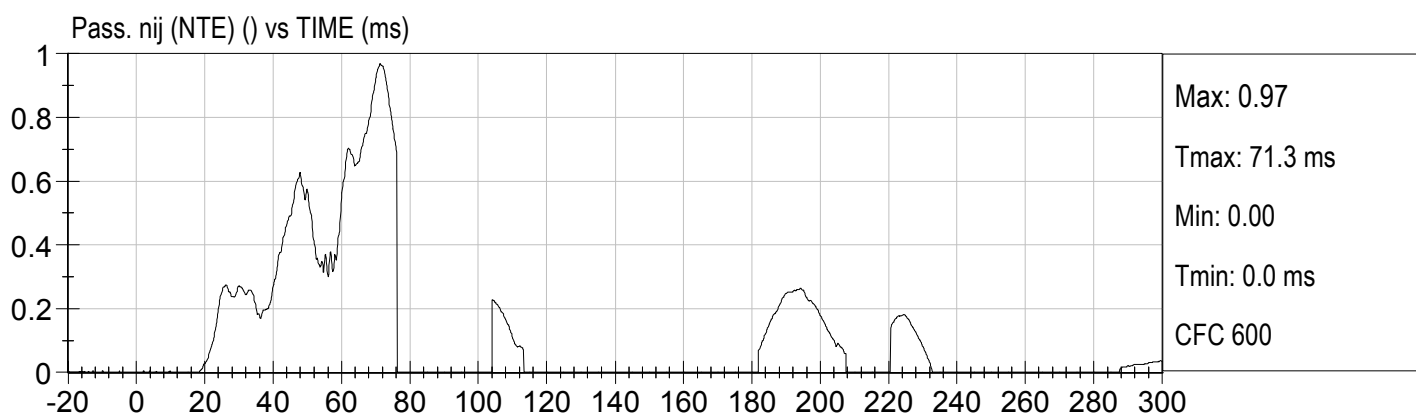
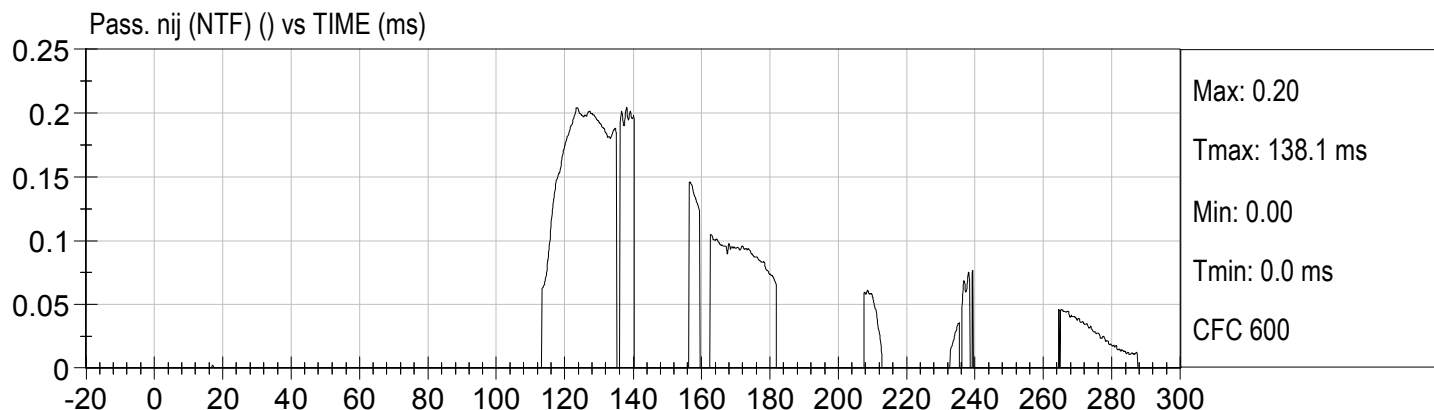


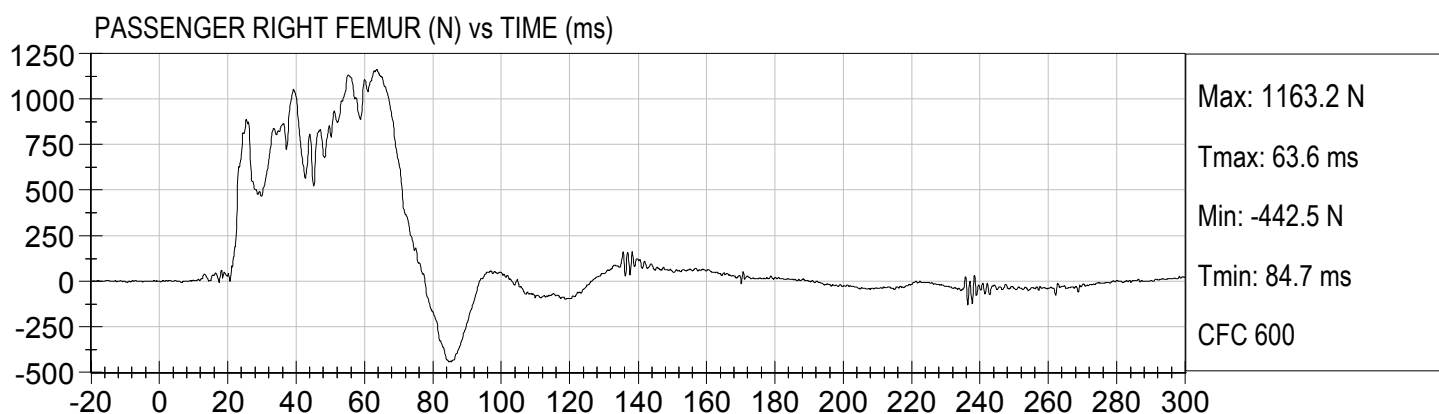
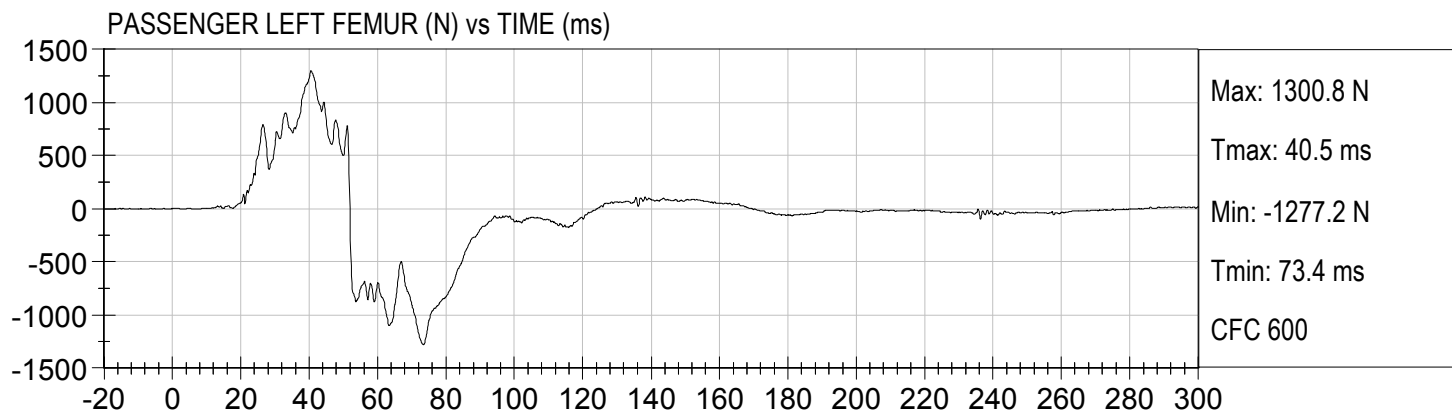












APPENDIX C
DUMMY CALIBRATION AND PERFORMANCE VERIFICATION DATA

Hybrid III, 50th External Measurements
SN: 036

HYBRID III, PART 572, SUBPART E EXTERNAL DIMENSIONS				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (inches)	ACTUAL MEASUREMENT
A	TOTAL SITTING HEIGHT	Seat surface to highest point on top of the head.	34.6–35.0	34.7
B	SHOULDER PIVOT HEIGHT	Centerline of shoulder pivot bolt to the seat surface.	19.9-20.5	20.0
C	H-POINT HEIGHT	Reference	3.3-3.5	3.4
D	H-POINT LOCATION FROM BACKLINE	Reference	5.3-5.5	5.4
E	SHOULDER PIVOT FROM BACKLINE	Center of the shoulder clevis to the rear vertical surface of the fixture.	3.3-3.7	3.6
F	THIGH CLEARANCE	Measured at the highest point on the upper femur segment.	5.5-6.1	5.8
G	BACK OF ELBOW TO WRIST PIVOT	back of the elbow flesh to the wrist pivot in line with the elbow and wrist pivots	11.4-12.0	11.5
H	HEAD BACK TO BACKLINE	Back of Skull cap skin to seat rear vertical surface (Reference)	1.6-1.8	1.7
I	SHOULDER TO- ELBOW LENGTH	Measure from the highest point on top of the shoulder clevis to the lowest part of the flesh on the elbow in line with the elbow pivot bolt.	13.0-13.6	13.0
J	ELBOW REST HEIGHT	Measure from the flesh below the elbow pivot bolt to the seat surface.	7.5-8.3	7.9
K	BUTTOCK TO KNEE LENGTH	The forward most part of the knee flesh to the rear vertical surface of the fixture.	22.8-23.8	23.8
L	POPLITEAL HEIGHT	Seat surface to the plane of the horizontal plane of the bottom of the feet.	16.9-17.9	17.3
M	KNEE PIVOT HEIGHT	Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.	19.1-19.7	19.5
N	BUTTOCK POPLITEAL LENGTH	The rearmost surface of the lower leg to the same point on the rear surface of the buttocks used for dim. "K".	17.8-18.8	17.9

HYBRID III, SUBPART E EXTERIOR DIMENSIONS, continued				
DIMENSION	DESCRIPTION	DETAILS		ACTUAL MEASUREMENT
O	CHEST DEPTH WITHOUT JACKET	Measured 16.9-17.1 in. above seat surface	8.4-9.0	8.8
P	FOOT LENGTH	Tip of toe to rear of heel	9.9-10.5	10.0
V	SHOULDER BREADTH	Outside edges of right and left shoulder clevises	16.3-17.2	16.4
W	FOOT BREADTH	The widest part of the foot	3.6-4.2	4.1
Y	CHEST CIRCUMFERENCE (WITH CHEST JACKET)	Measured 16.9-17.1 in. above seat surface	38.2-39.4	38.4
Z	WAIST CIRCUMFERENCE	Measured 8.9-9.1 in. above seat surface	32.9-34.1	34.0
AA	REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE	Reference	16.9-17.1	17.0
BB	REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE	Reference	8.9-9.1	9.0

NOTE: THE H-POINT IS LOCATED 1.83 INCHES FORWARD AND 2.57 INCHES DOWN FROM THE CENTER OF THE PELVIS ANGLE REFERENCE HOLE.

MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 036

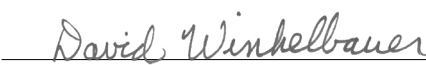
Test ID: D132081

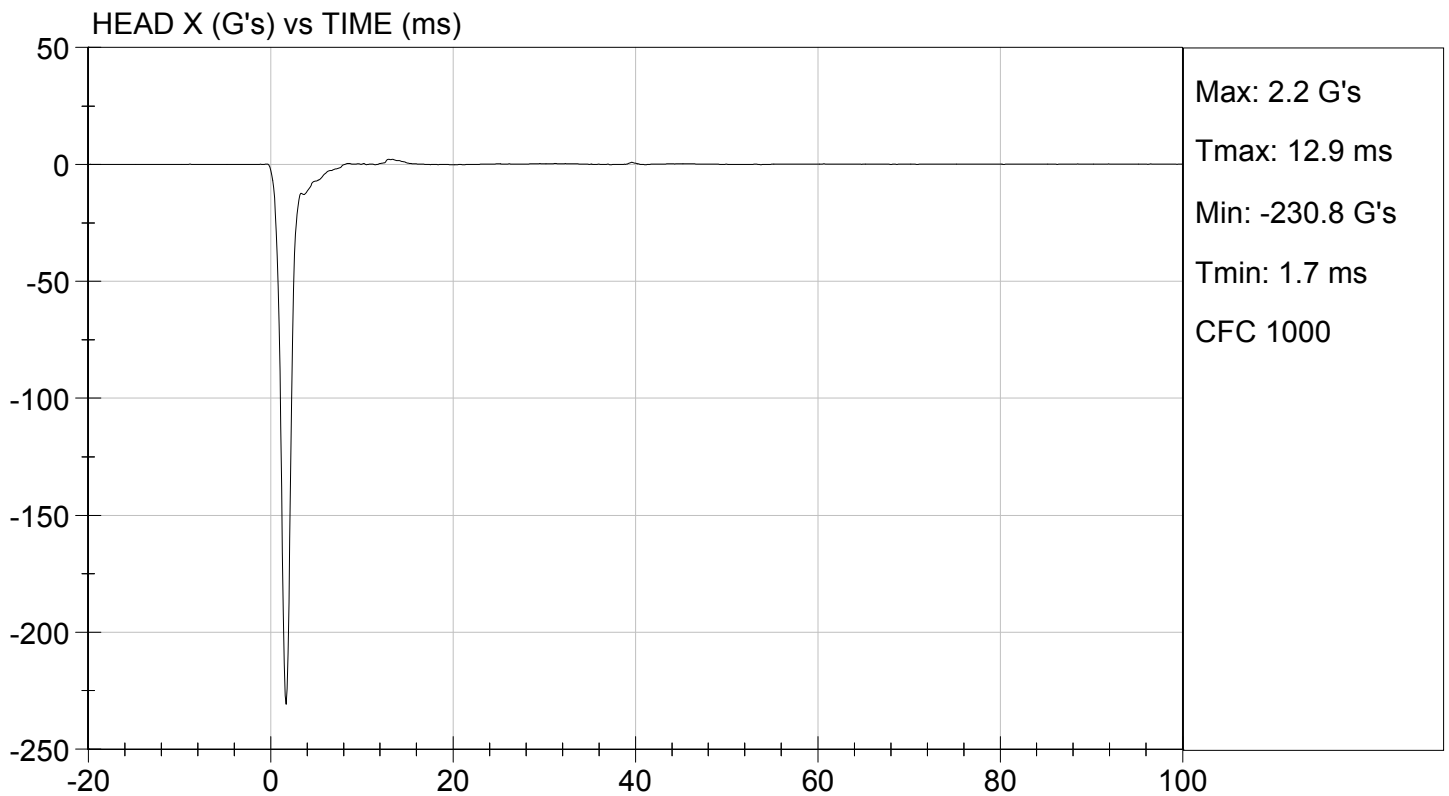
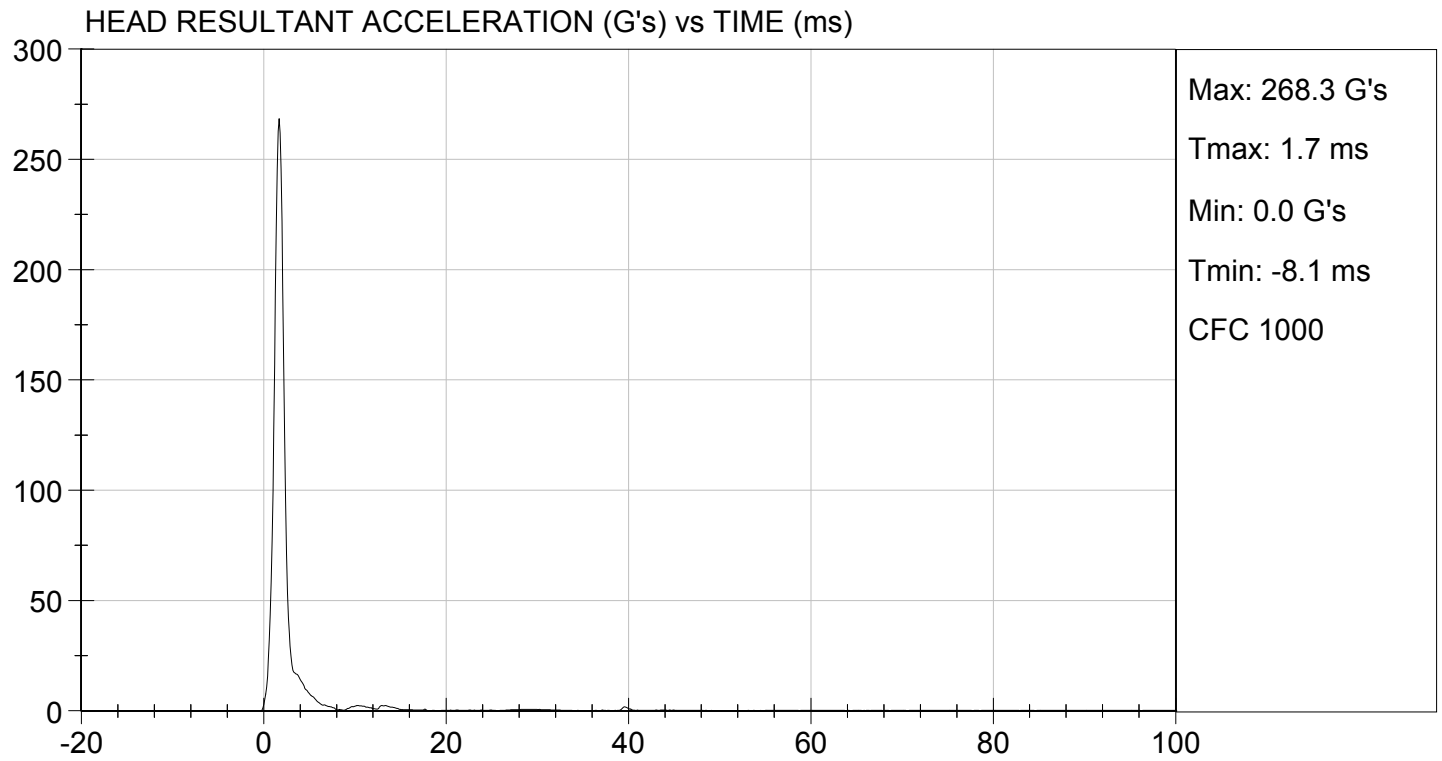
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	20.9	Pass
Laboratory Relative Humidity	%	10 to 70	49	Pass
Peak Resultant Acceleration	G's	225 to 275	268	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-3.0	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

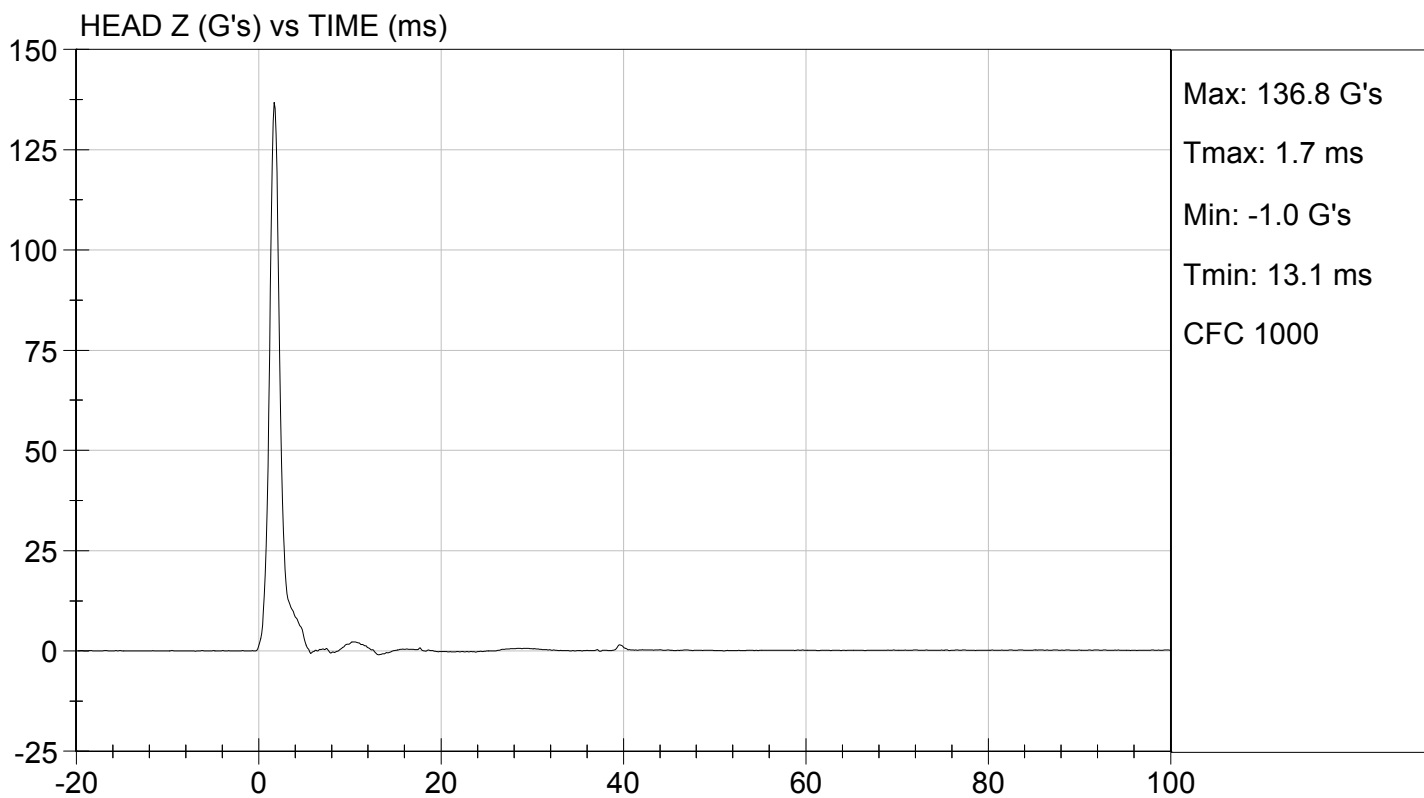
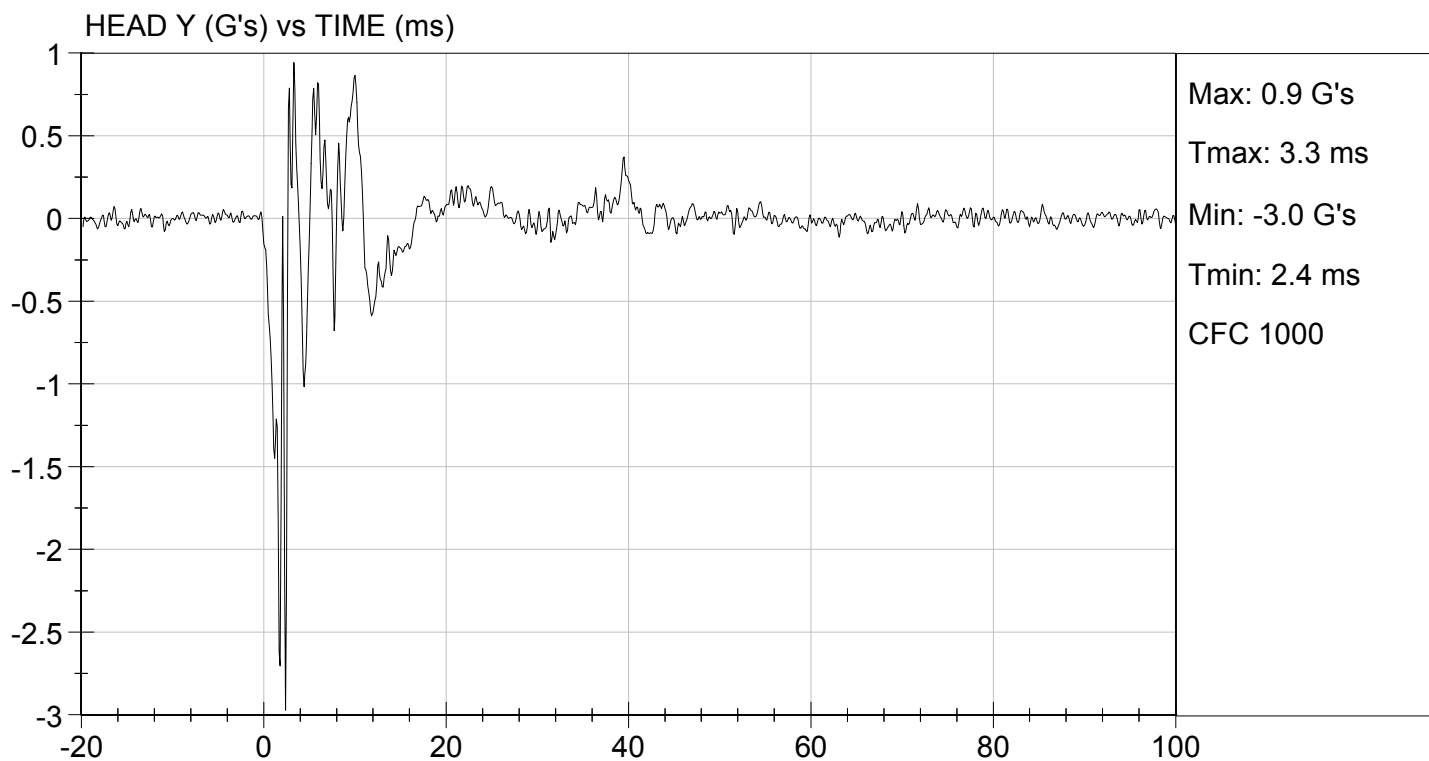

Laboratory Technician

07/01/2013

Test Date


Approved By





MGA RESEARCH CORPORATION
NECK FLEXION TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 036

Test I.D: D132082

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.5	Pass
Laboratory Relative Humidity		%	10 to 70	45	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.05	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	23.77	Pass
	20 ms	G's	17.60 to 22.60	19.24	Pass
	30 ms	G's	12.50 to 18.50	14.32	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	14.2	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	35.6	Pass
Maximum "D" Plane Rotation	Maximum	Deg	64.0 to 78.0	74.1	Pass
	Time	ms	57.0 to 64.0	59.0	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	115.9	Pass
Moment About Occipital Condyle	Maximum	Nm	88.1 to 108.5	92.3	Pass
	Time	ms	47.0 to 58.0	49.4	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	98.0	Pass
Overall Test Results					Pass

Jessica Hall
Laboratory Technician

07/01/2013

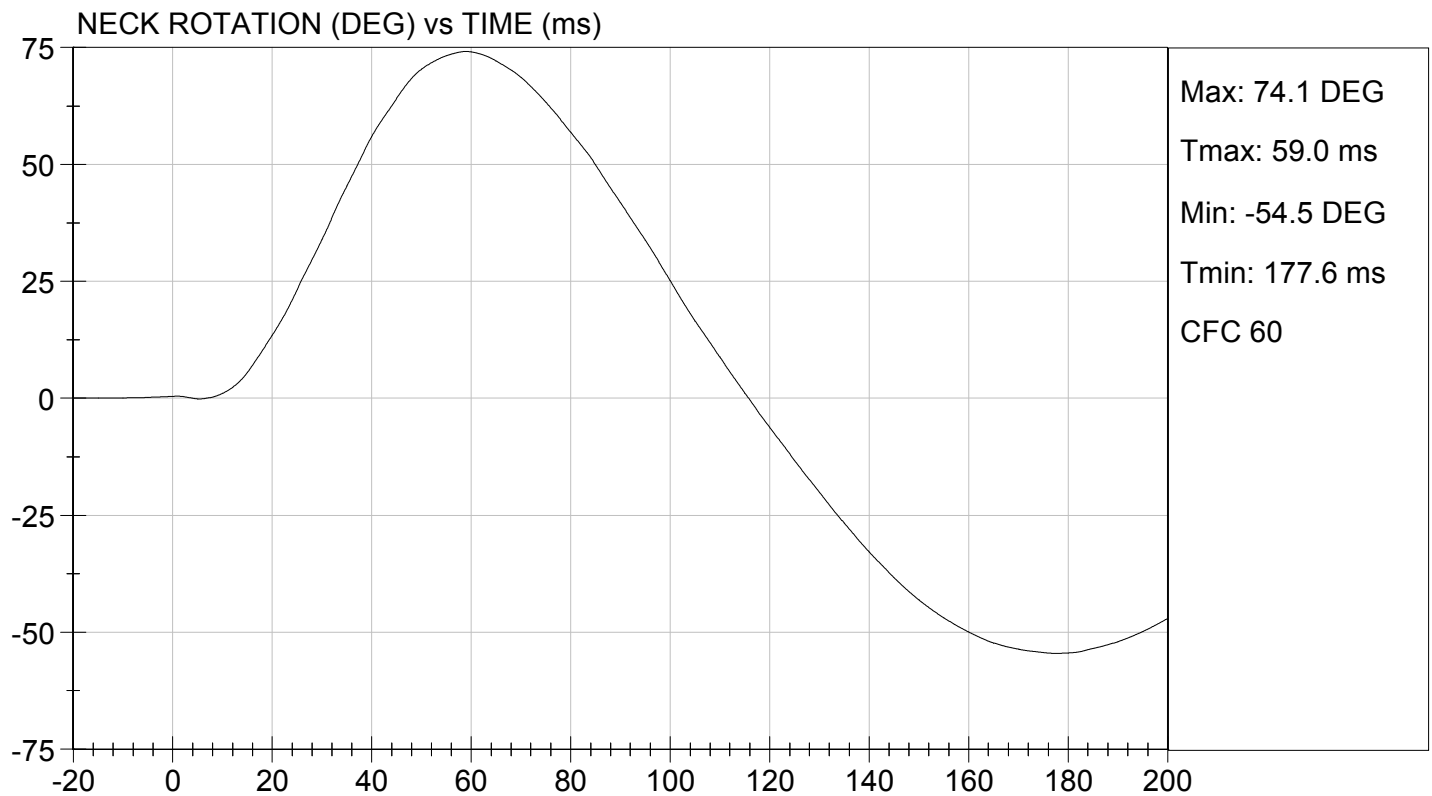
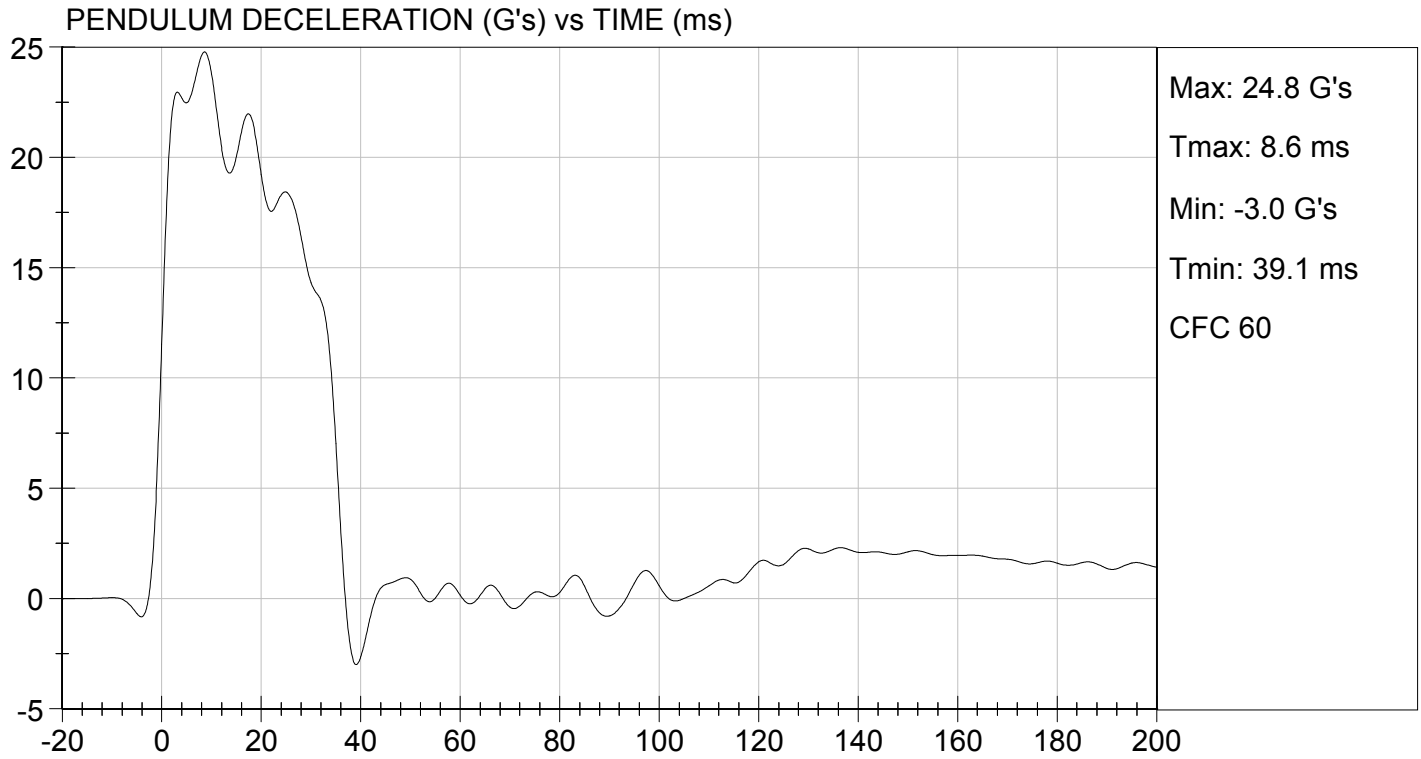
Test Date

David Winkelbauer
Approved By



TEST DESC: NECK FLEXION
VELOCITY: 23.14 ft/s, 7.05 m/s

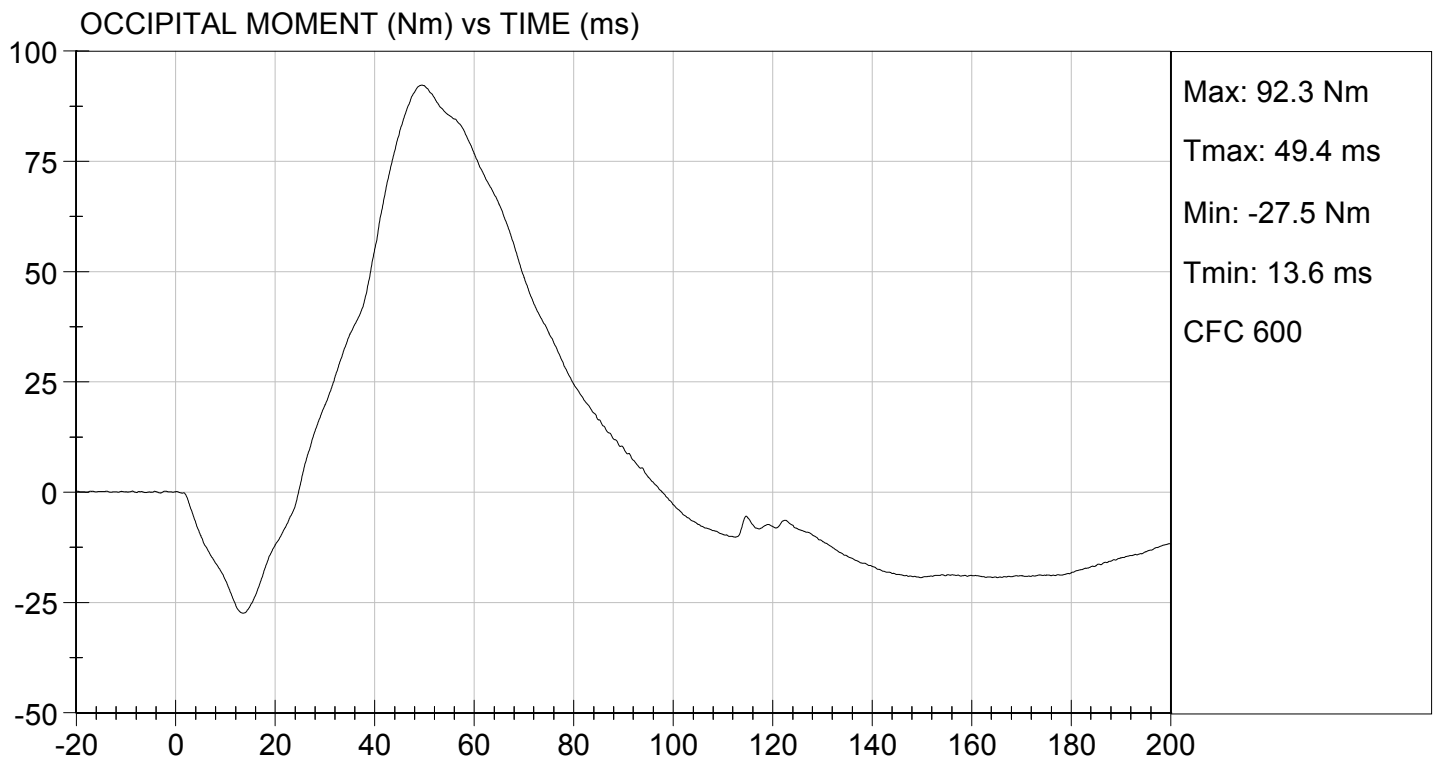
TEST DATE: 07/01/2013
TEST #: D132082





TEST DESC: NECK FLEXION
VELOCITY: 23.14 ft/s, 7.05 m/s

TEST DATE: 07/01/2013
TEST #: D132082

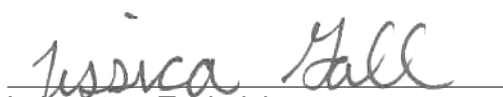


MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 036

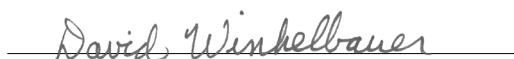
Test I.D: D132083

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.5	Pass
Laboratory Relative Humidity		%	10 to 70	45	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.12	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	18.29	Pass
	20 ms	G's	14.00 to 19.00	14.67	Pass
	30 ms	G's	11.00 to 16.00	11.70	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	11.6	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	42.0	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	99.2	Pass
	Time	ms	72.0 to 82.0	78.2	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	160.1	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-64.6	Pass
	Time	ms	65.0 to 79.0	73.3	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	145.9	Pass
Overall Test Results					Pass


Laboratory Technician

07/01/2013

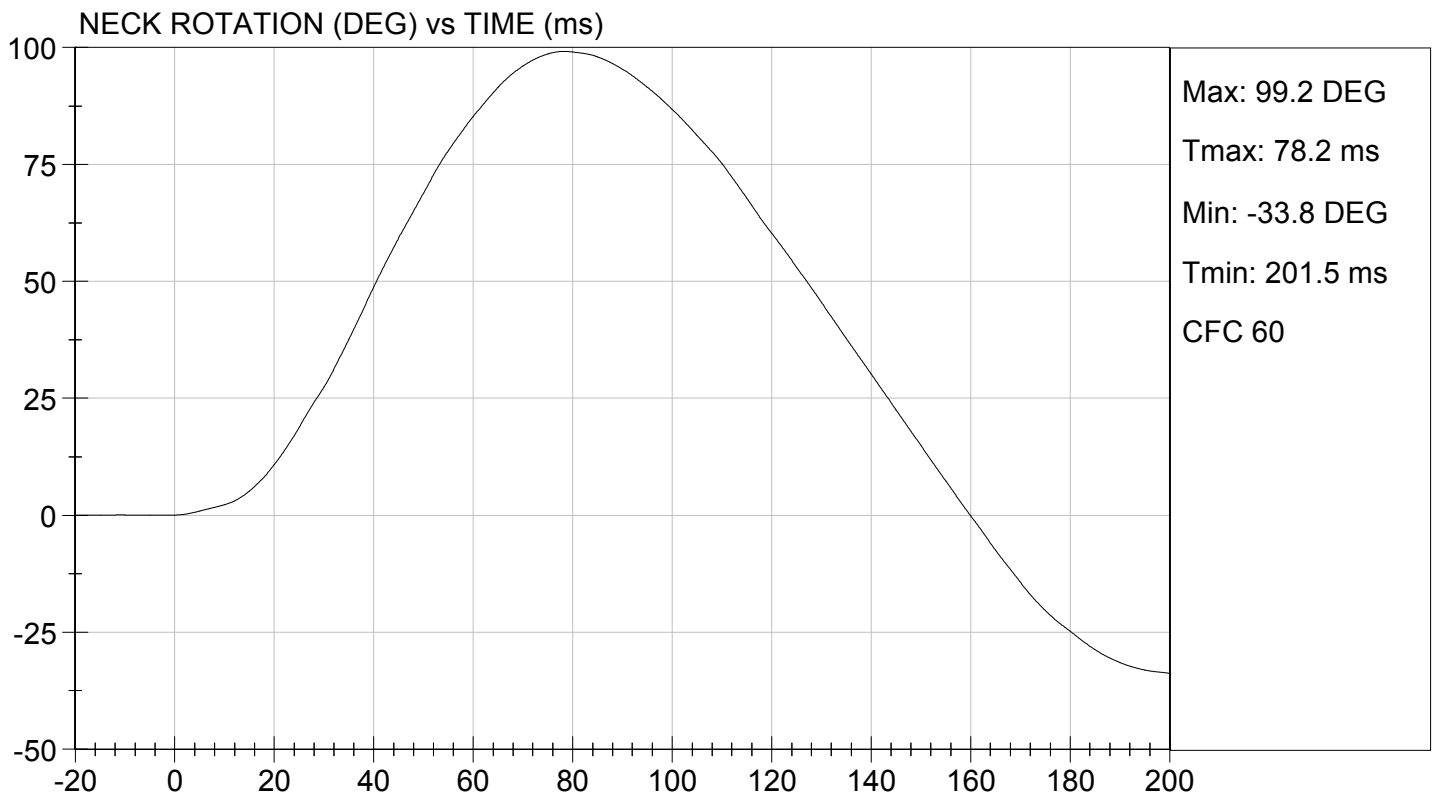
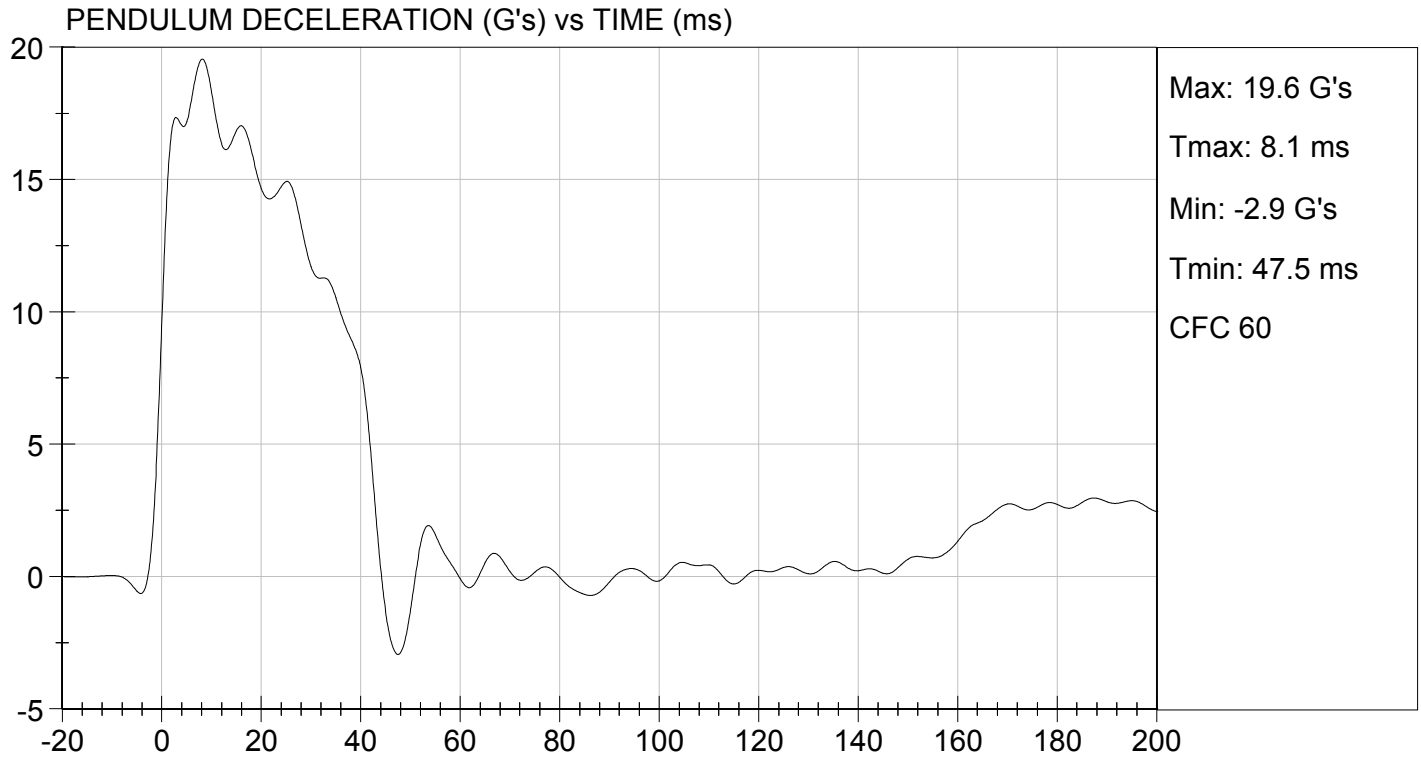
Test Date


Approved By



TEST DESC: NECK EXTENSION
VELOCITY: 20.08 ft/s, 6.12 m/s

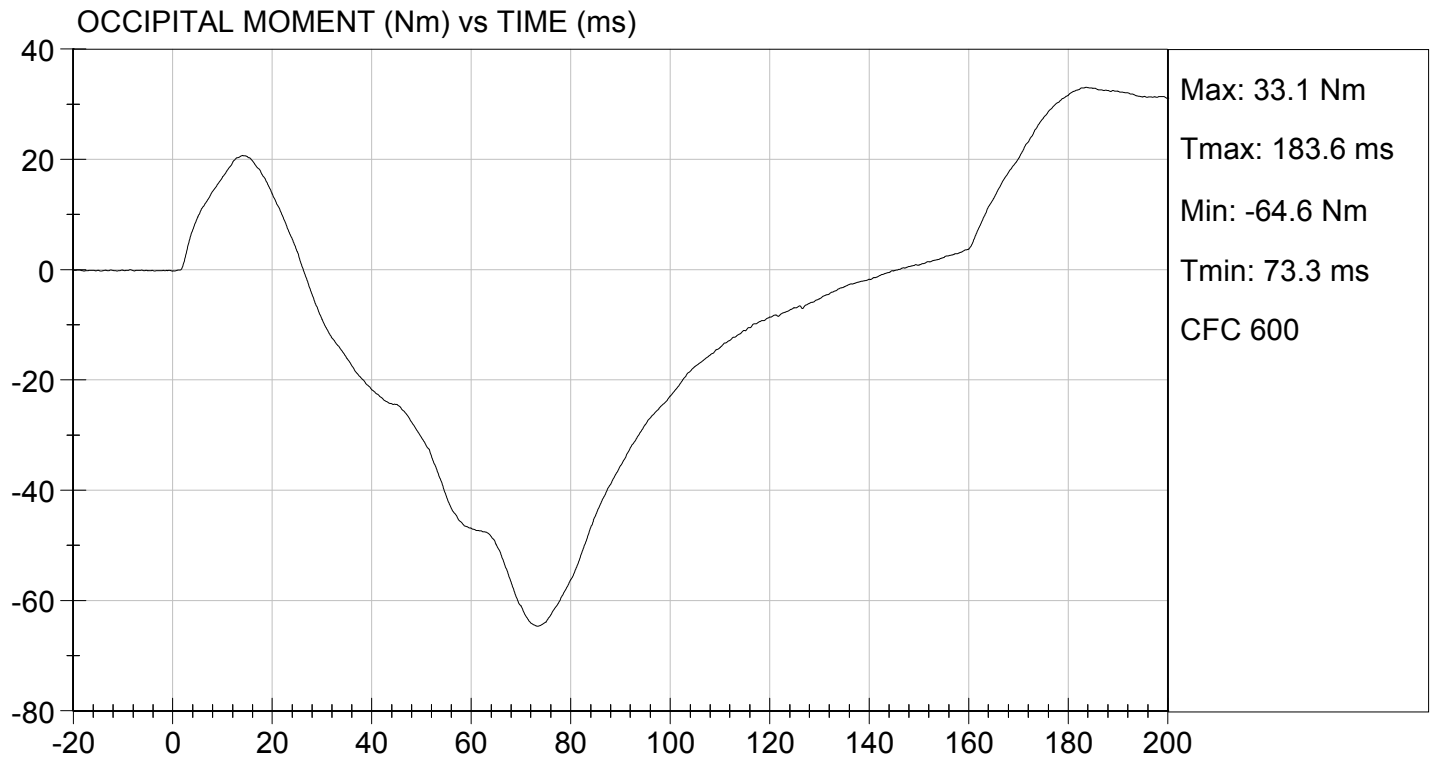
TEST DATE: 07/01/2013
TEST #: D132083





TEST DESC: NECK EXTENSION
VELOCITY: 20.08 ft/s, 6.12 m/s

TEST DATE: 07/01/2013
TEST #: D132083



MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 50TH PERCENTILE MALE

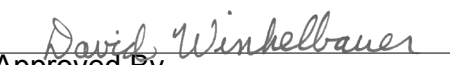
ATD Serial No: 036

Test I.D: D132084

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	42	Pass
Probe Velocity	m/s	6.58 to 6.82	6.80	Pass
Peak Probe Force	N	5159 to 5893	5,446	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.37	Pass
Internal Hysteresis	%	69 to 85	74	Pass
			Overall Test Results	Pass


Laboratory Technician

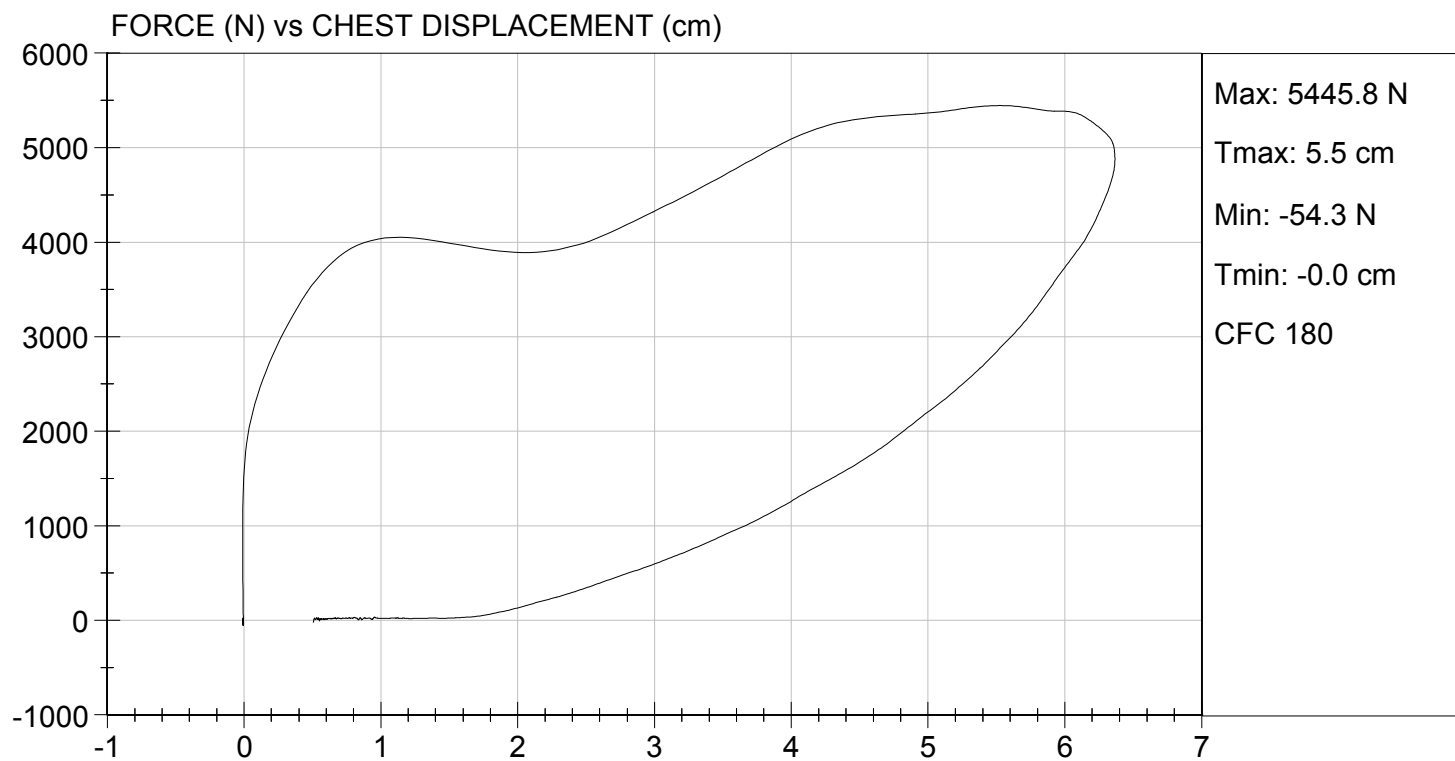
07/01/2013
Test Date


Approved By



TEST DESC: THORAX IMPACT
VELOCITY: 22.32 ft/s, 6.80 m/s

TEST DATE: 07/01/2013
TEST #: D132084



MGA RESEARCH CORPORATION
RIGHT KNEE IMPACT TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 036

Test I.D: D132085

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.0	Pass
Laboratory Relative Humidity	%	10 to 70	43	Pass
Probe Velocity	m/s	2.07 to 2.13	2.12	Pass
Peak Probe Force	N	4715 to 5782	5,434	Pass
Overall Test Results				Pass


Laboratory Technician

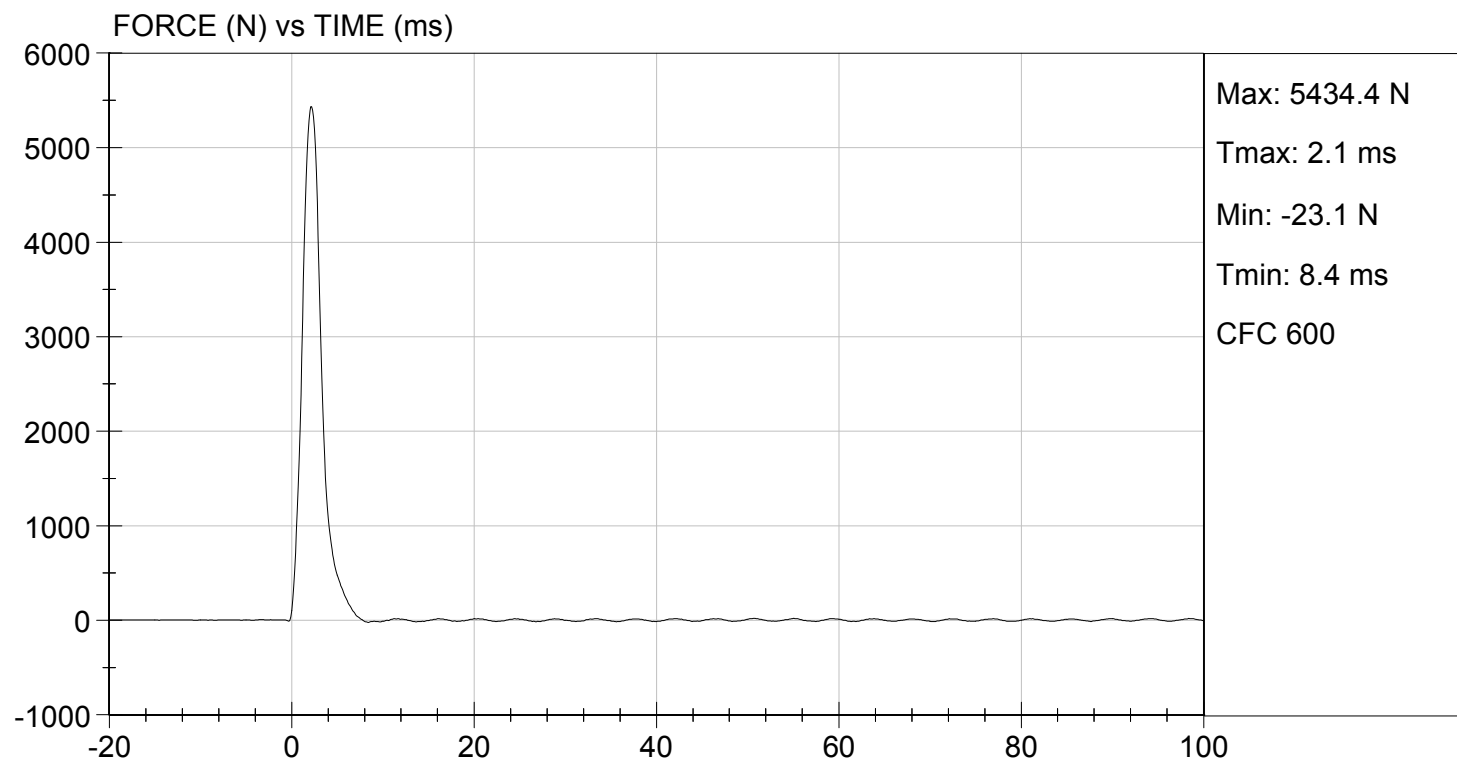
07/01/2013
Test Date


Approved By



TEST DESC: RIGHT KNEE
VELOCITY: 6.97 ft/s, 2.12 m/s

TEST DATE: 07/01/2013
TEST #: D132085



MGA RESEARCH CORPORATION
LEFT KNEE IMPACT TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 036

Test I.D: D132086

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.0	Pass
Laboratory Relative Humidity	%	10 to 70	43	Pass
Probe Velocity	m/s	2.07 to 2.13	2.12	Pass
Peak Probe Force	N	4715 to 5782	5,675	Pass
			Overall Test Results	Pass


Laboratory Technician

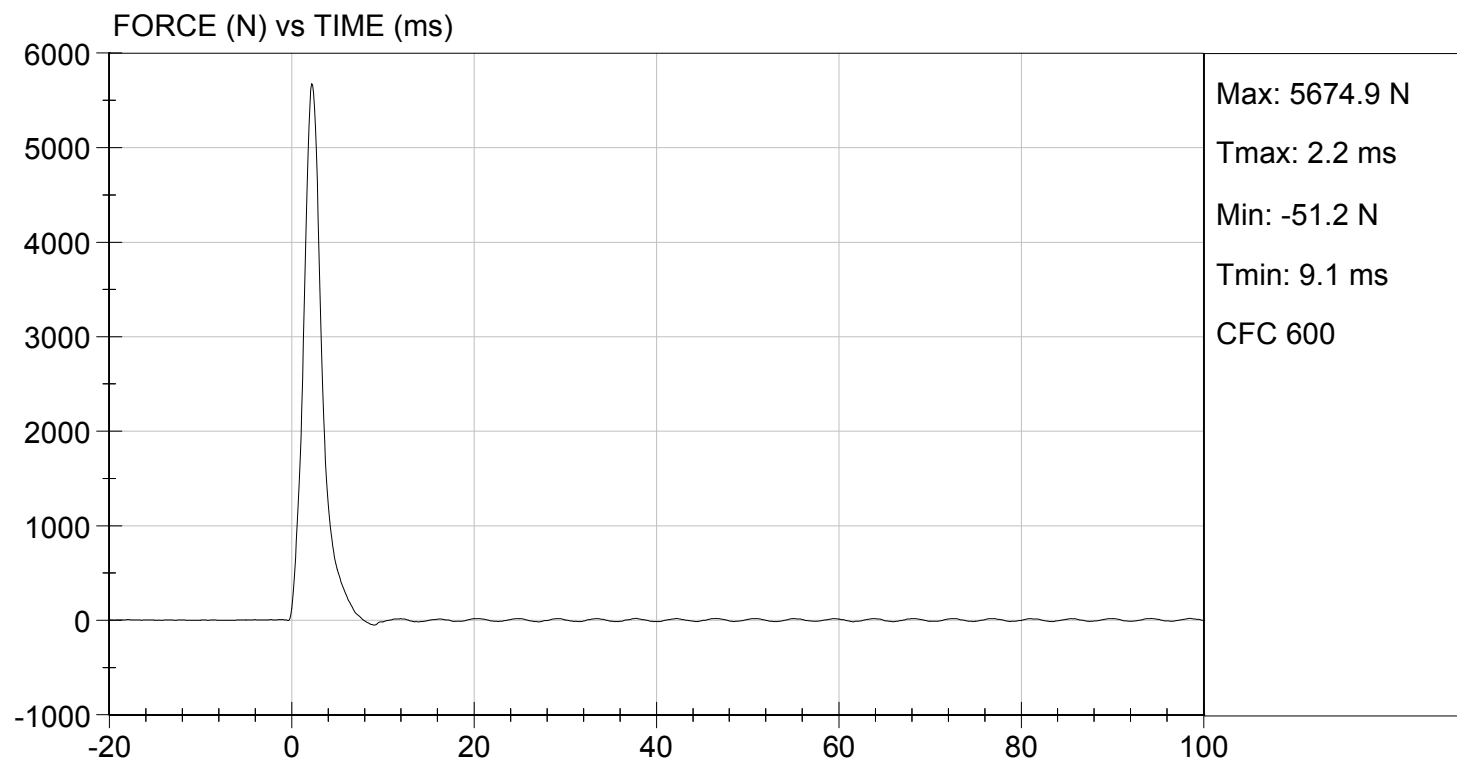
07/01/2013
Test Date


Approved By



TEST DESC: LEFT KNEE
VELOCITY: 6.97 ft/s, 2.12 m/s

TEST DATE: 07/01/2013
TEST #: D132086



MGA RESEARCH CORPORATION
HIP-FEMUR FLEXION TEST
HYBRID III 50TH PERCENTILE MALE

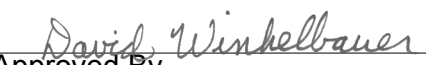
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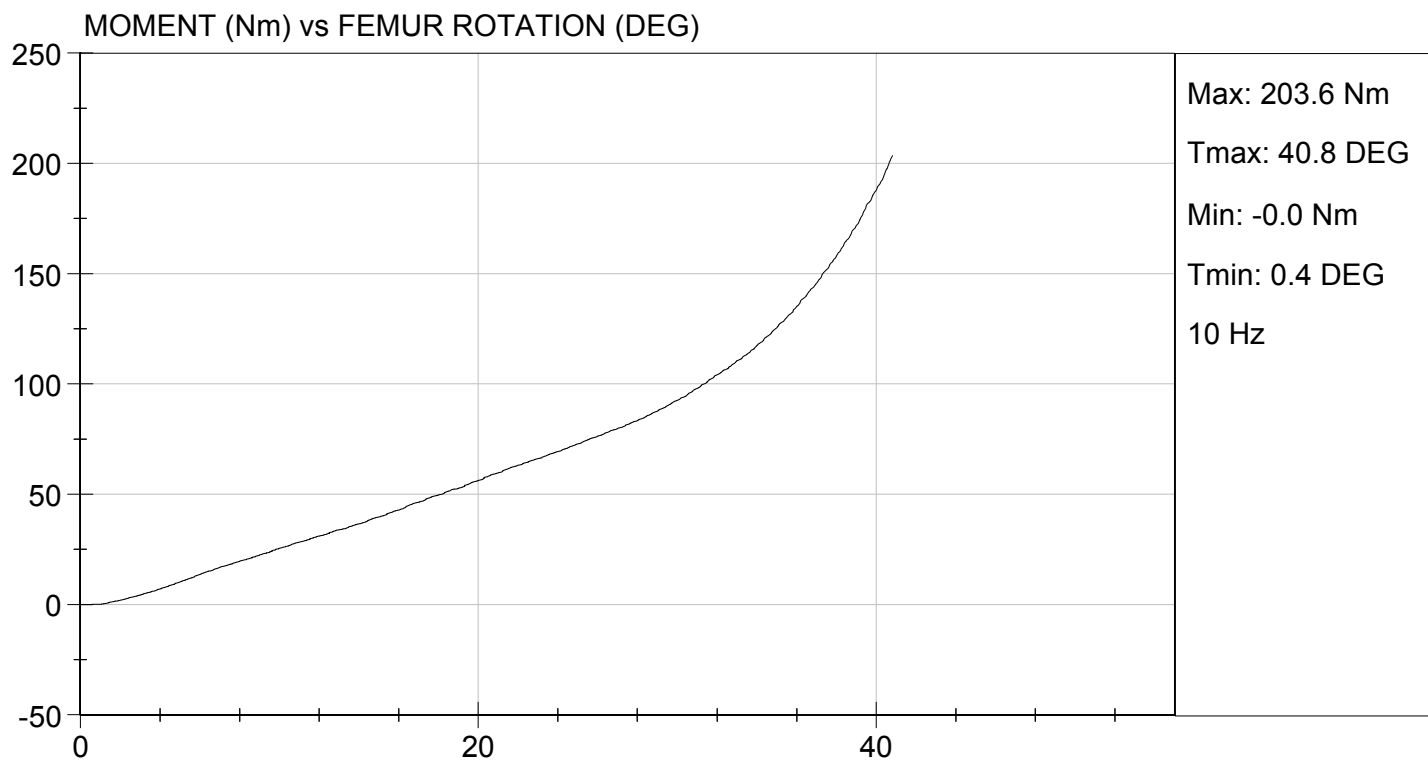
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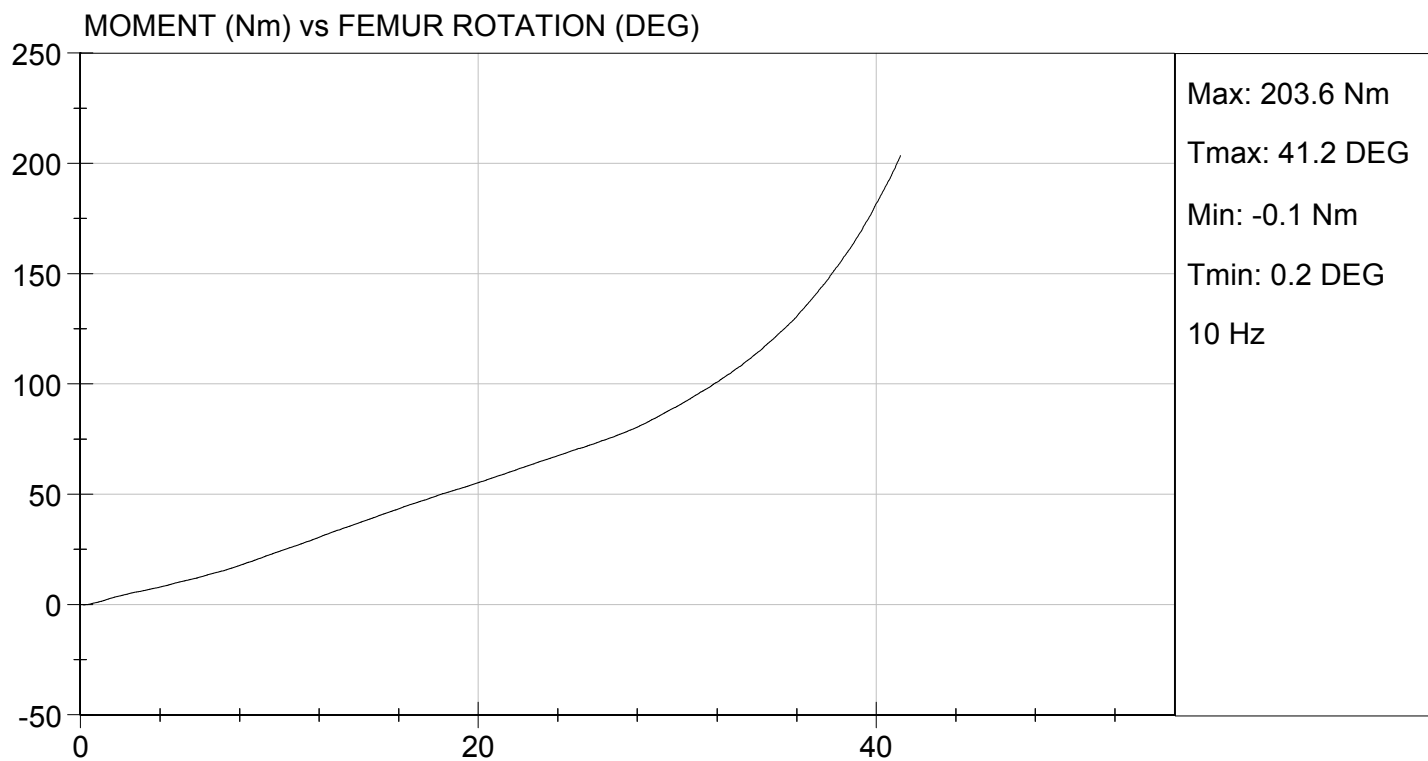
Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.1	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	41	41	Pass
Rotation Rate	deg/s	5.0 to 10.0	6.1	6.2	Pass
30 Degrees	Nm	94.9 Nm Max	92.6	90.0	Pass
150 ft-lbf / 203.4 Nm	Deg	40.0 to 50.0 Degree Max Rotation	40.8	41.2	Pass
Overall Test Results					Pass


Laboratory Technician

07/01/2013
Test Date


Approved By





MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 036

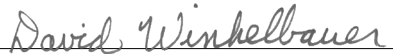
Test ID: D132191

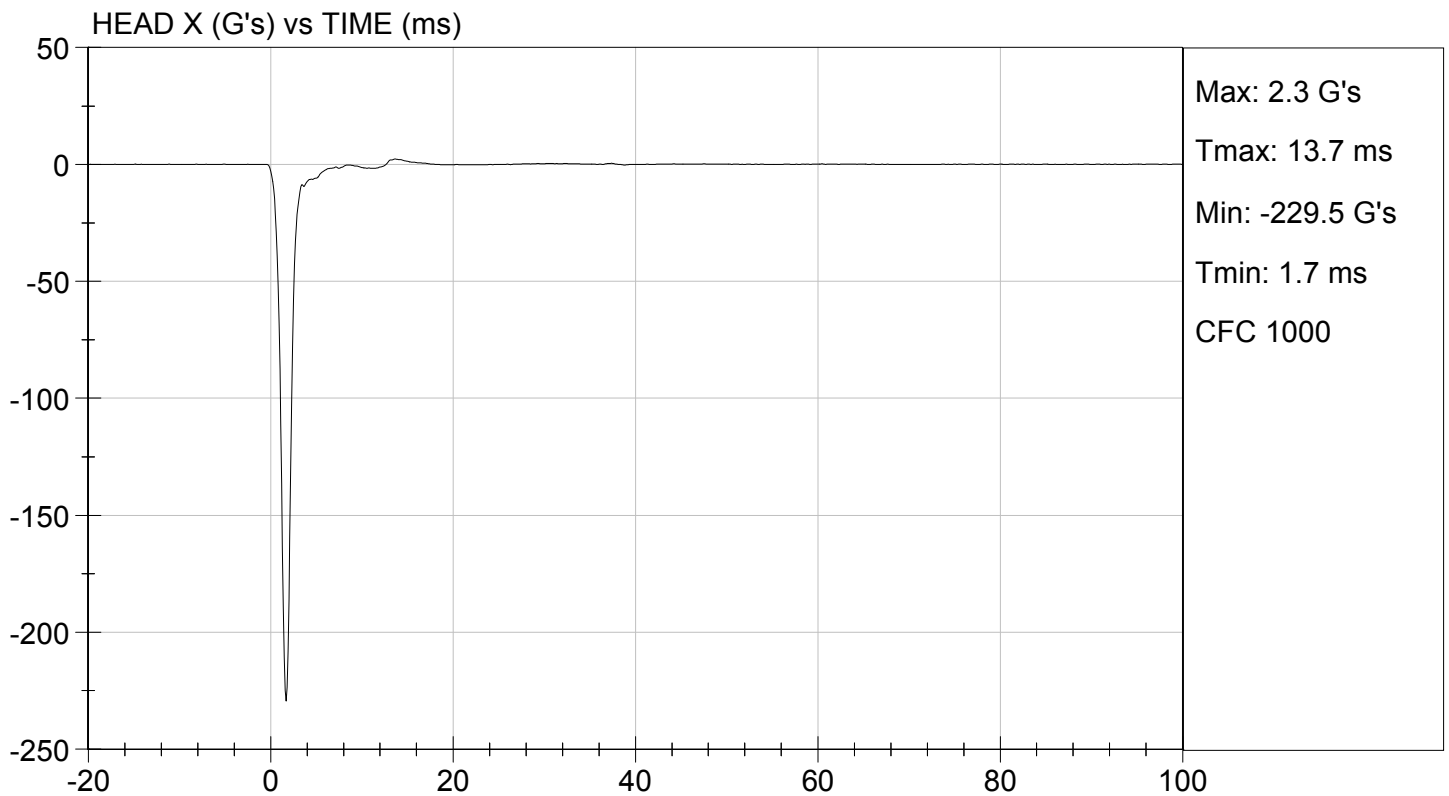
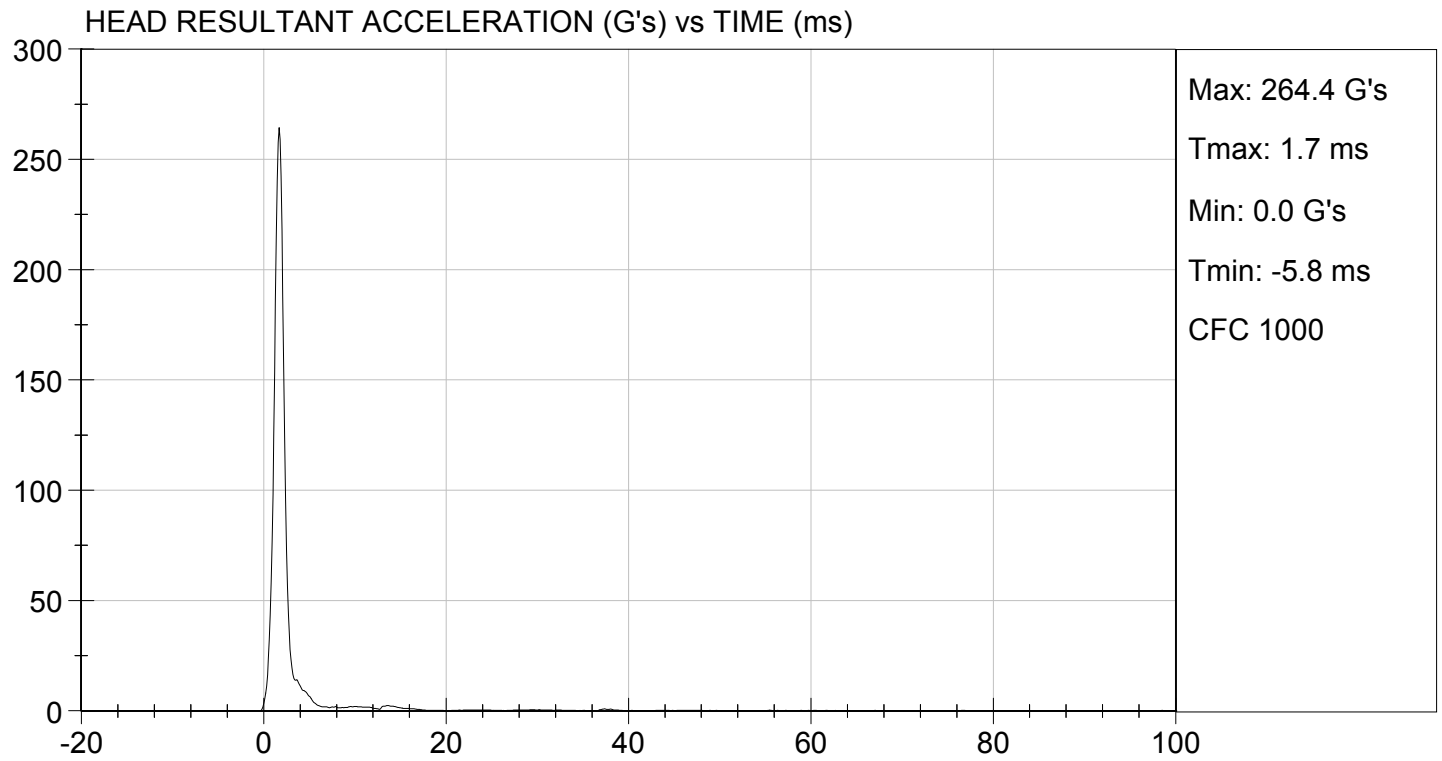
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	20.9	Pass
Laboratory Relative Humidity	%	10 to 70	55	Pass
Peak Resultant Acceleration	G's	225 to 275	264	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	8.1	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

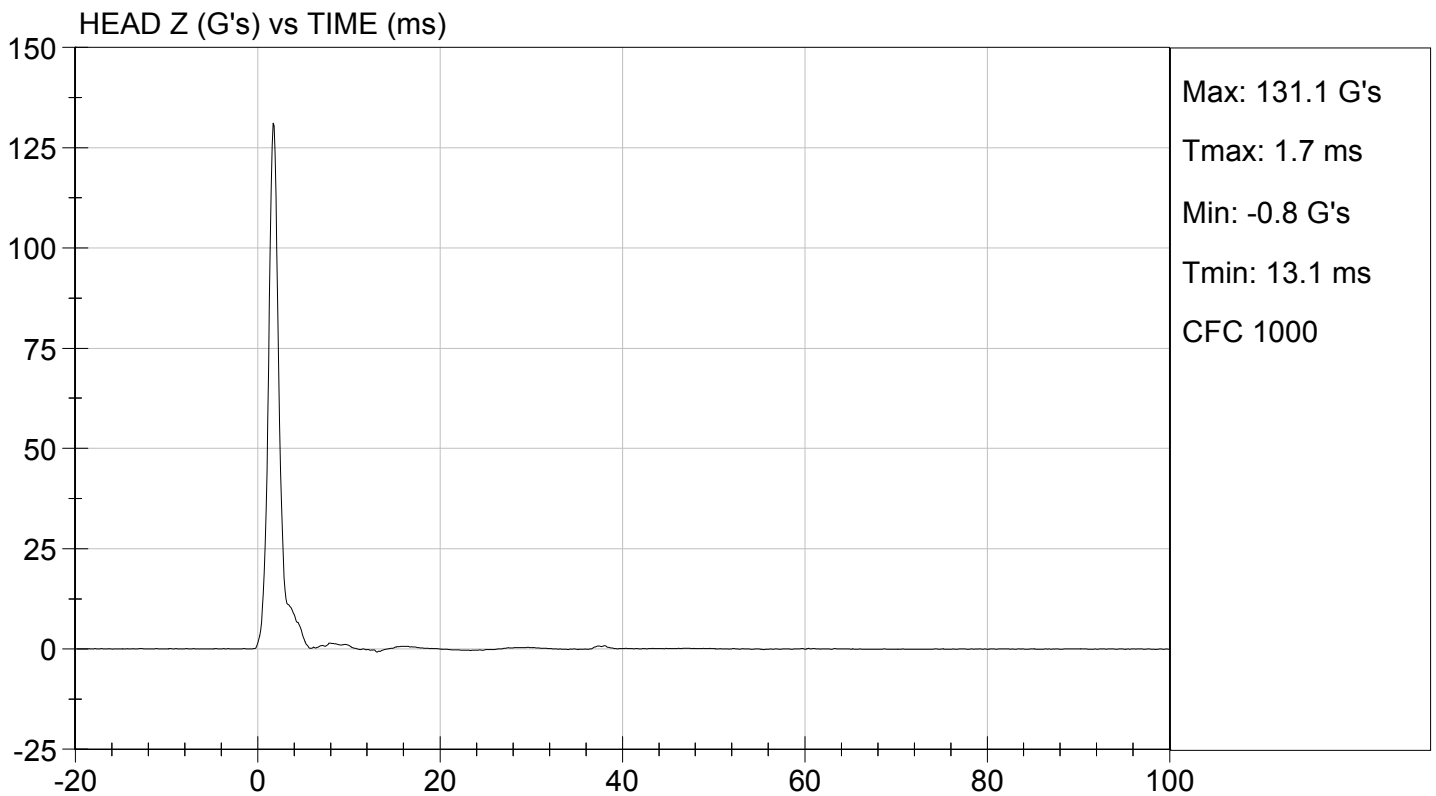
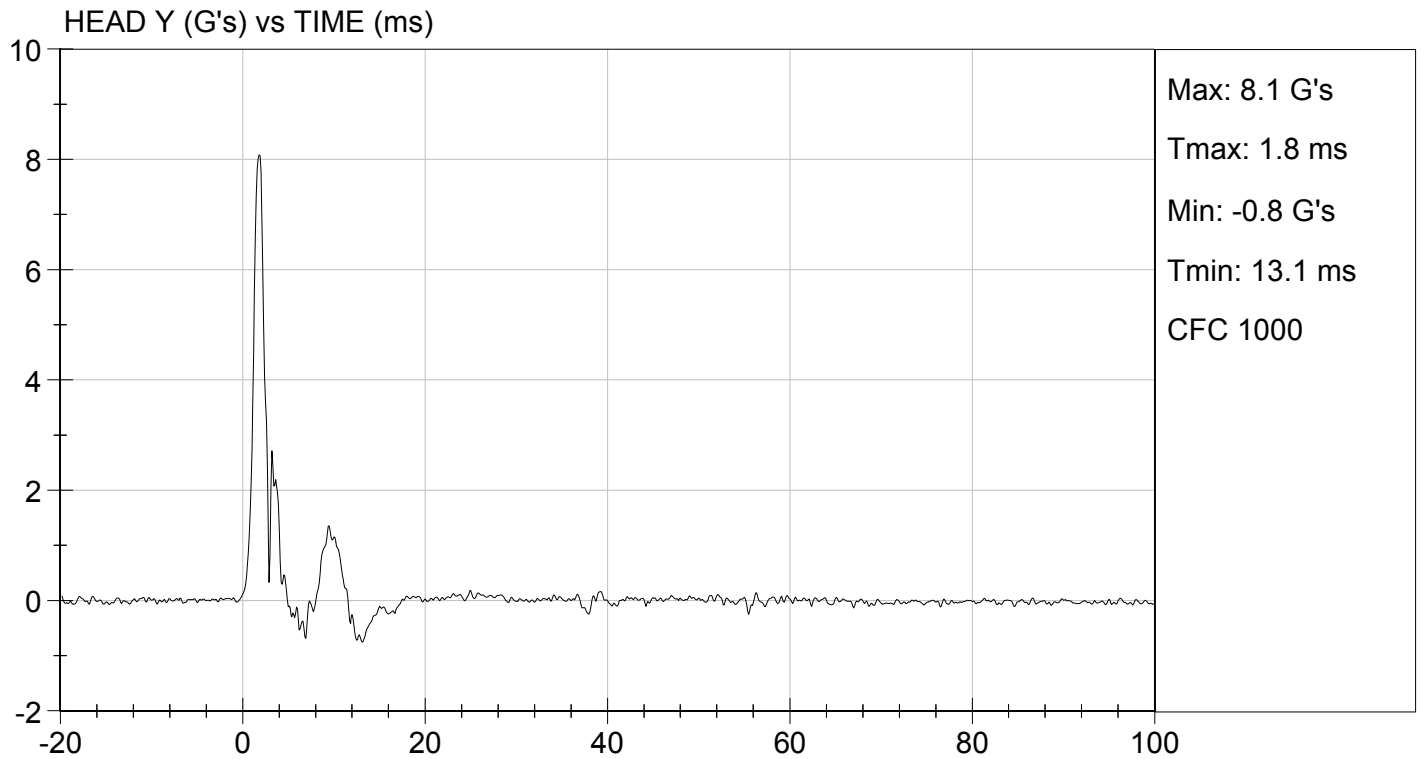

Laboratory Technician

07/08/2013

Test Date


Approved By





MGA RESEARCH CORPORATION
NECK FLEXION TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 036

Test I.D: D132192

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.0	Pass
Laboratory Relative Humidity		%	10 to 70	50	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.07	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	23.64	Pass
	20 ms	G's	17.60 to 22.60	18.35	Pass
	30 ms	G's	12.50 to 18.50	14.22	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	14.2	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	36.0	Pass
Maximum "D" Plane Rotation	Maximum	Deg	64.0 to 78.0	71.0	Pass
	Time	ms	57.0 to 64.0	59.3	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	118.6	Pass
Moment About Occipital Condyle	Maximum	Nm	88.1 to 108.5	89.5	Pass
	Time	ms	47.0 to 58.0	50.0	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	98.4	Pass
Overall Test Results					Pass

Jessica Hall
Laboratory Technician

07/08/2013

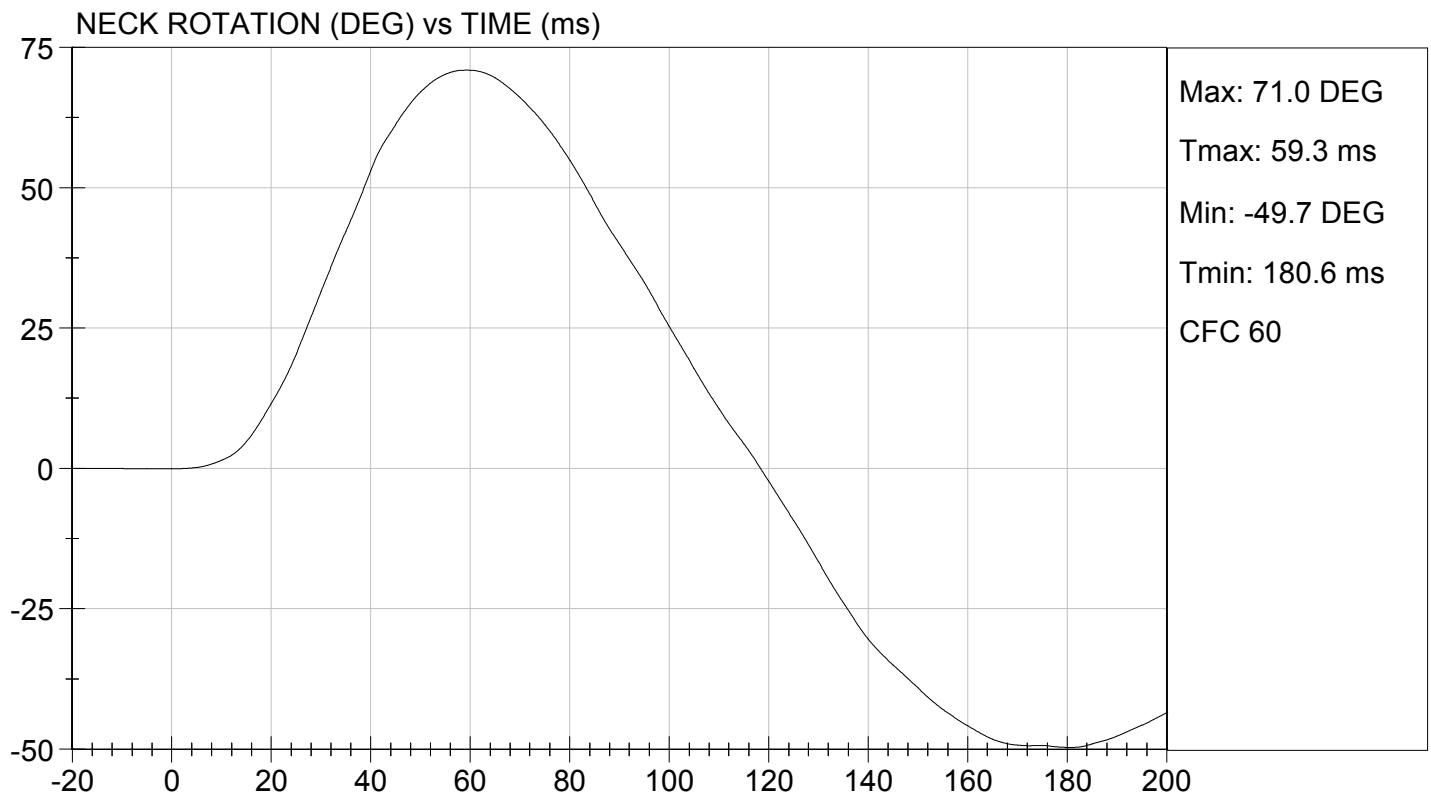
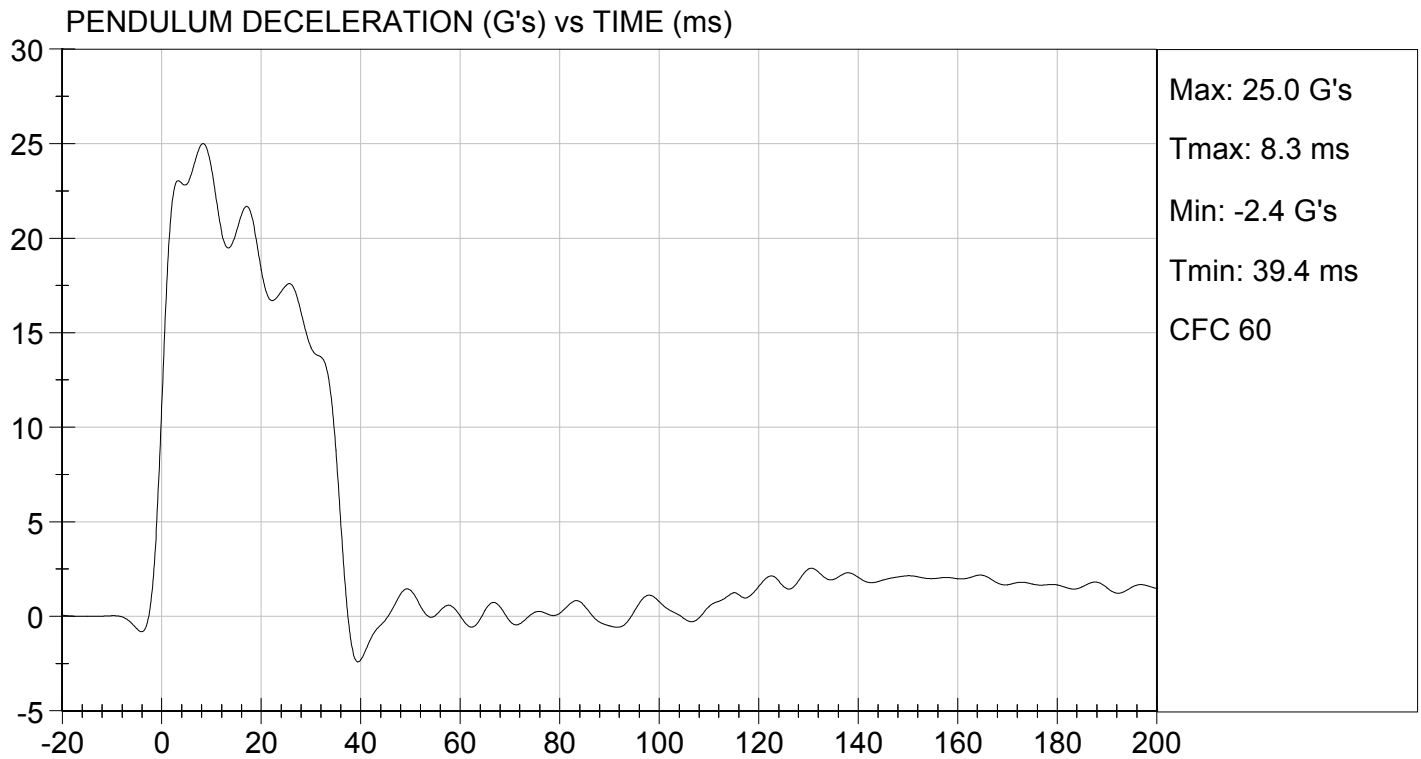
Test Date

David Winkelbauer
Approved By



TEST DESC: NECK FLEXION
VELOCITY: 23.21 ft/s, 7.07 m/s

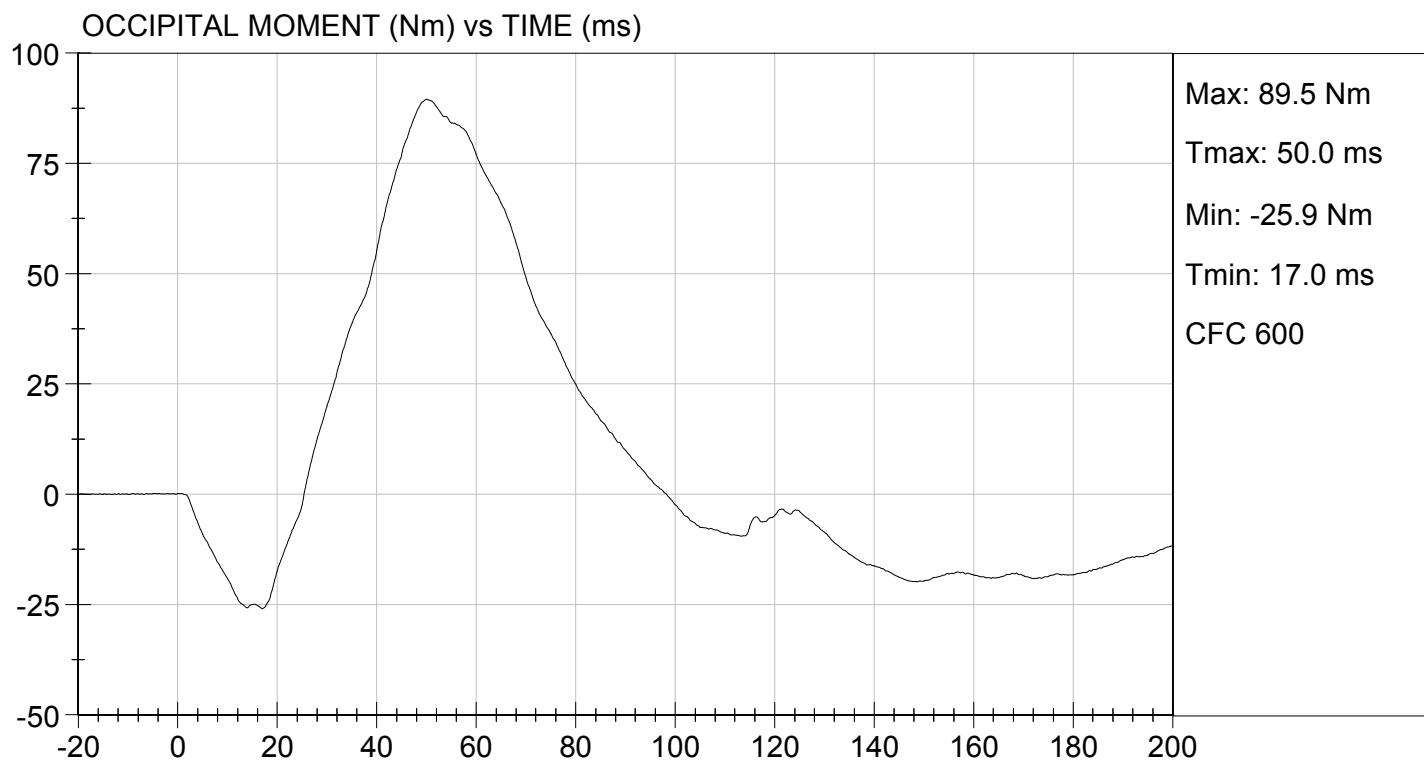
TEST DATE: 07/08/2013
TEST #: D132192





TEST DESC: NECK FLEXION
VELOCITY: 23.21 ft/s, 7.07 m/s

TEST DATE: 07/08/2013
TEST #: D132192

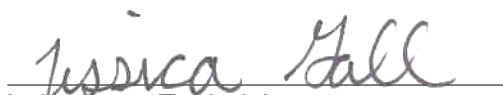


MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 036

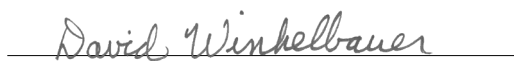
Test I.D: D132193

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.0	Pass
Laboratory Relative Humidity		%	10 to 70	50	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.16	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	17.90	Pass
	20 ms	G's	14.00 to 19.00	15.83	Pass
	30 ms	G's	11.00 to 16.00	12.47	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	12.5	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	40.1	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	96.9	Pass
	Time	ms	72.0 to 82.0	77.7	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	158.6	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-66.2	Pass
	Time	ms	65.0 to 79.0	72.2	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	144.1	Pass
Overall Test Results					Pass


Laboratory Technician

07/08/2013

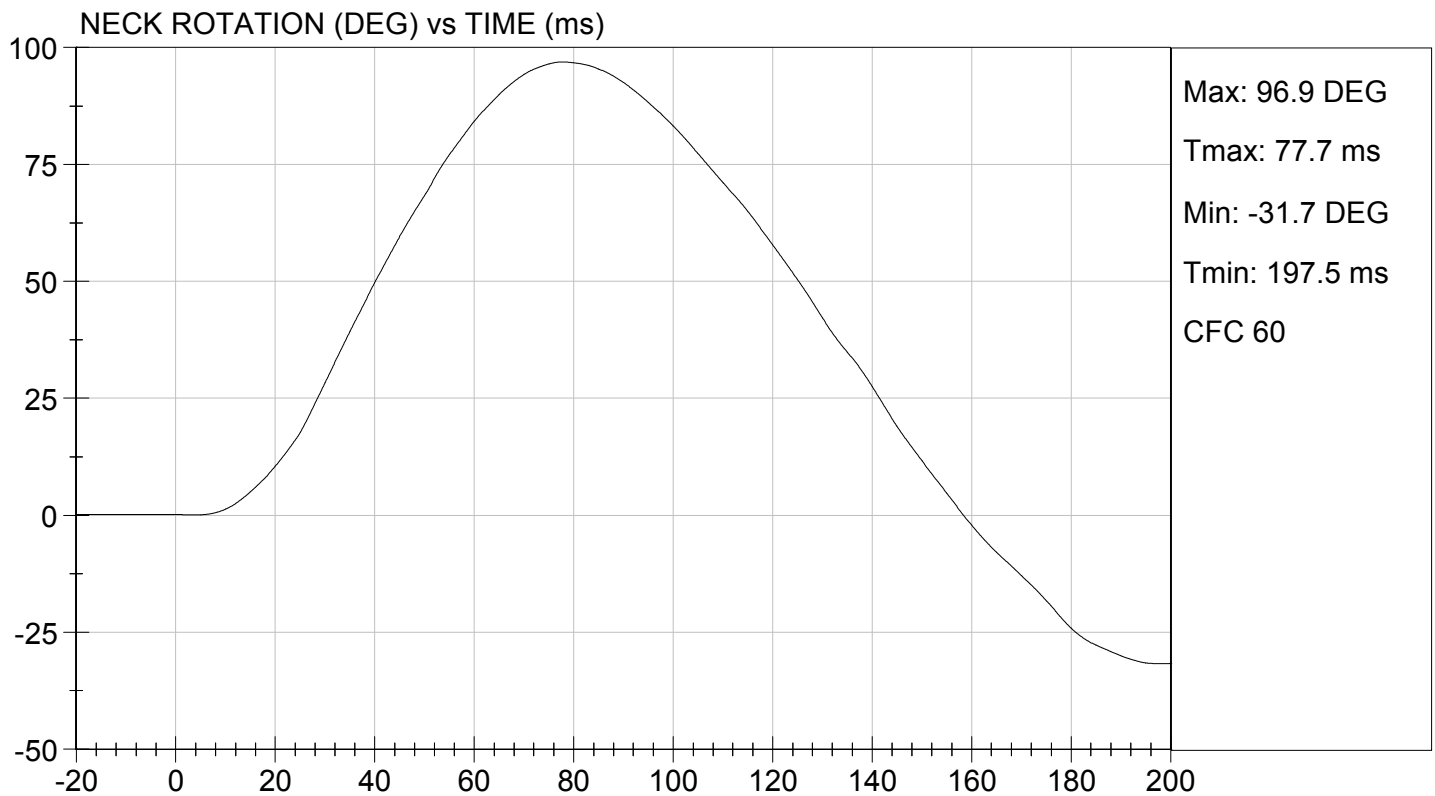
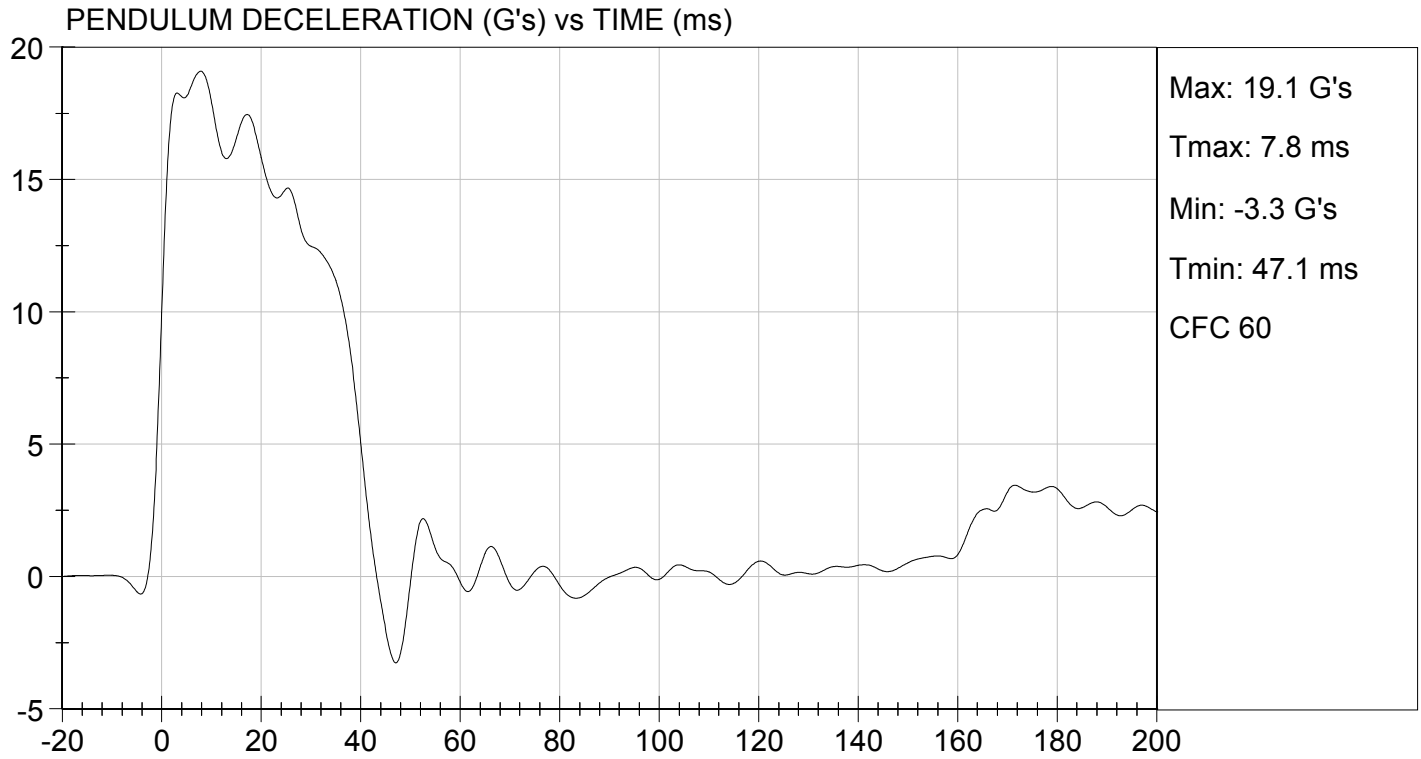
Test Date


Approved By



TEST DESC: NECK EXTENSION
VELOCITY: 20.22 ft/s, 6.16 m/s

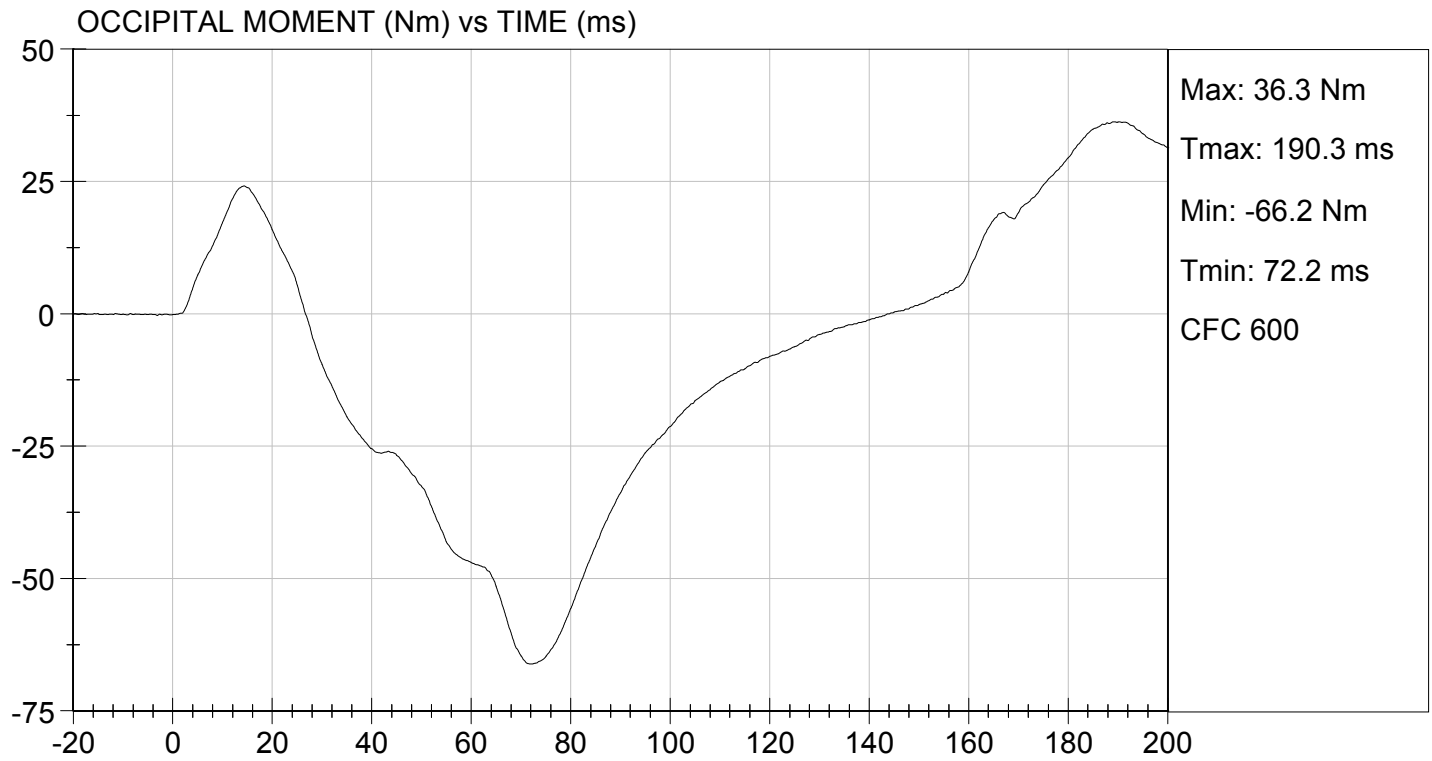
TEST DATE: 07/08/2013
TEST #: D132193





TEST DESC: NECK EXTENSION
VELOCITY: 20.22 ft/s, 6.16 m/s

TEST DATE: 07/08/2013
TEST #: D132193



MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 036

Test I.D: D132194

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	52	Pass
Probe Velocity	m/s	6.58 to 6.82	6.77	Pass
Peak Probe Force	N	5159 to 5893	5,193	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.60	Pass
Internal Hysteresis	%	69 to 85	71	Pass
			Overall Test Results	Pass


Laboratory Technician

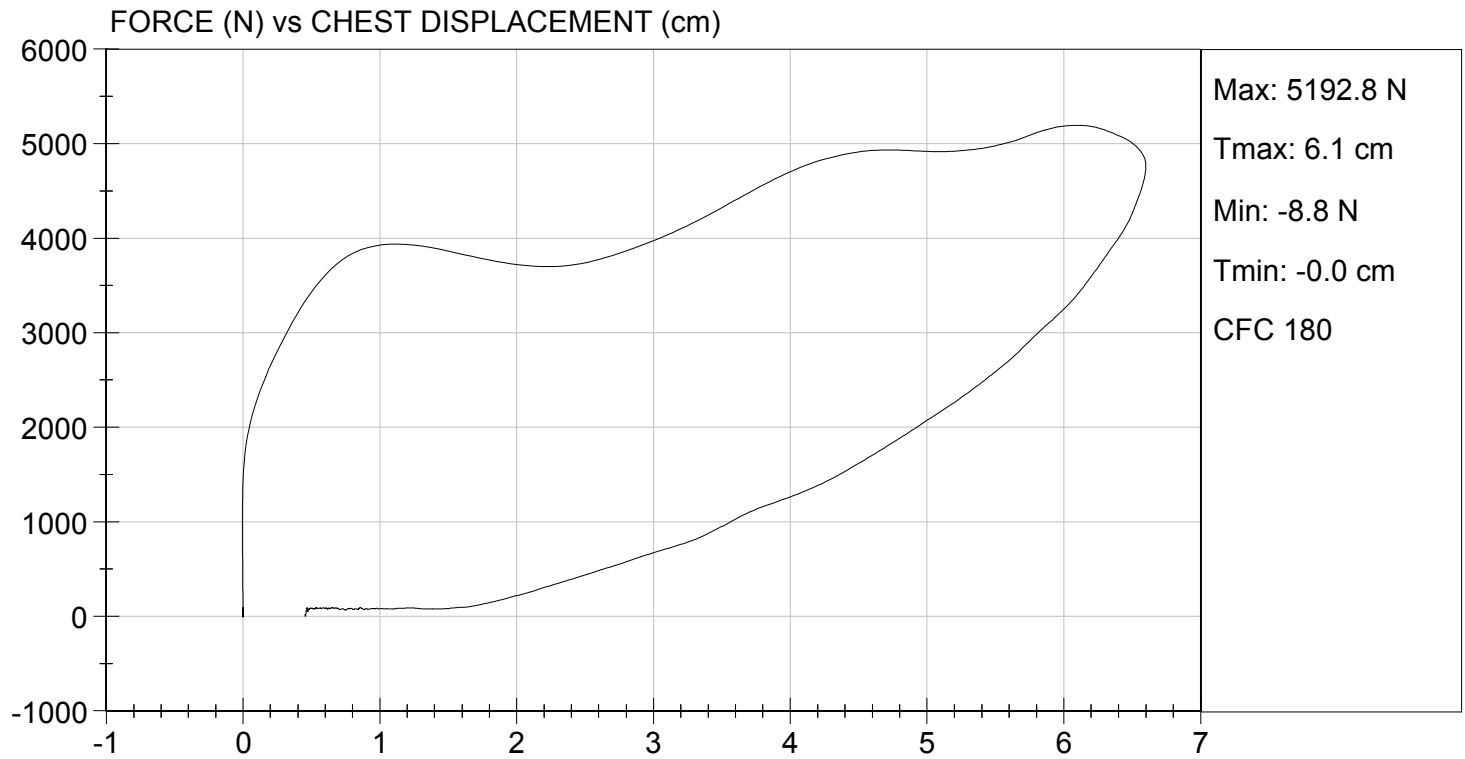
07/09/2013
Test Date


Approved By



TEST DESC: THORAX IMPACT
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 07/09/2013
TEST #: D132194



MGA RESEARCH CORPORATION
RIGHT KNEE IMPACT TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 036

Test I.D: D132195

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.0	Pass
Laboratory Relative Humidity	%	10 to 70	58	Pass
Probe Velocity	m/s	2.07 to 2.13	2.11	Pass
Peak Probe Force	N	4715 to 5782	5,071	Pass
Overall Test Results				Pass


Laboratory Technician

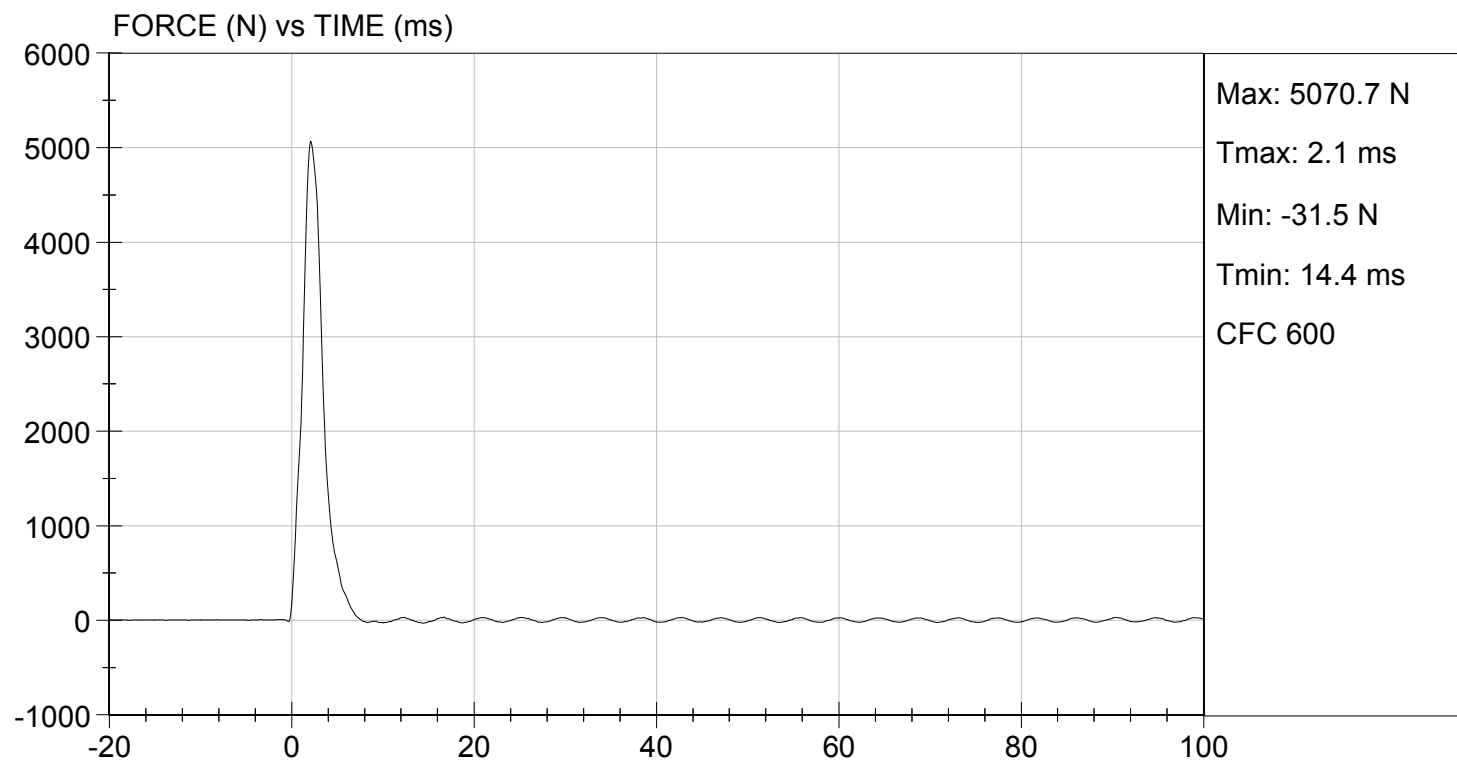
07/08/2013
Test Date


Approved By



TEST DESC: RIGHT KNEE
VELOCITY: 6.92 ft/s, 2.11 m/s

TEST DATE: 07/08/2013
TEST #: D132195



MGA RESEARCH CORPORATION
LEFT KNEE IMPACT TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 036

Test I.D: D132196

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.0	Pass
Laboratory Relative Humidity	%	10 to 70	58	Pass
Probe Velocity	m/s	2.07 to 2.13	2.08	Pass
Peak Probe Force	N	4715 to 5782	5,312	Pass
Overall Test Results				Pass


Laboratory Technician

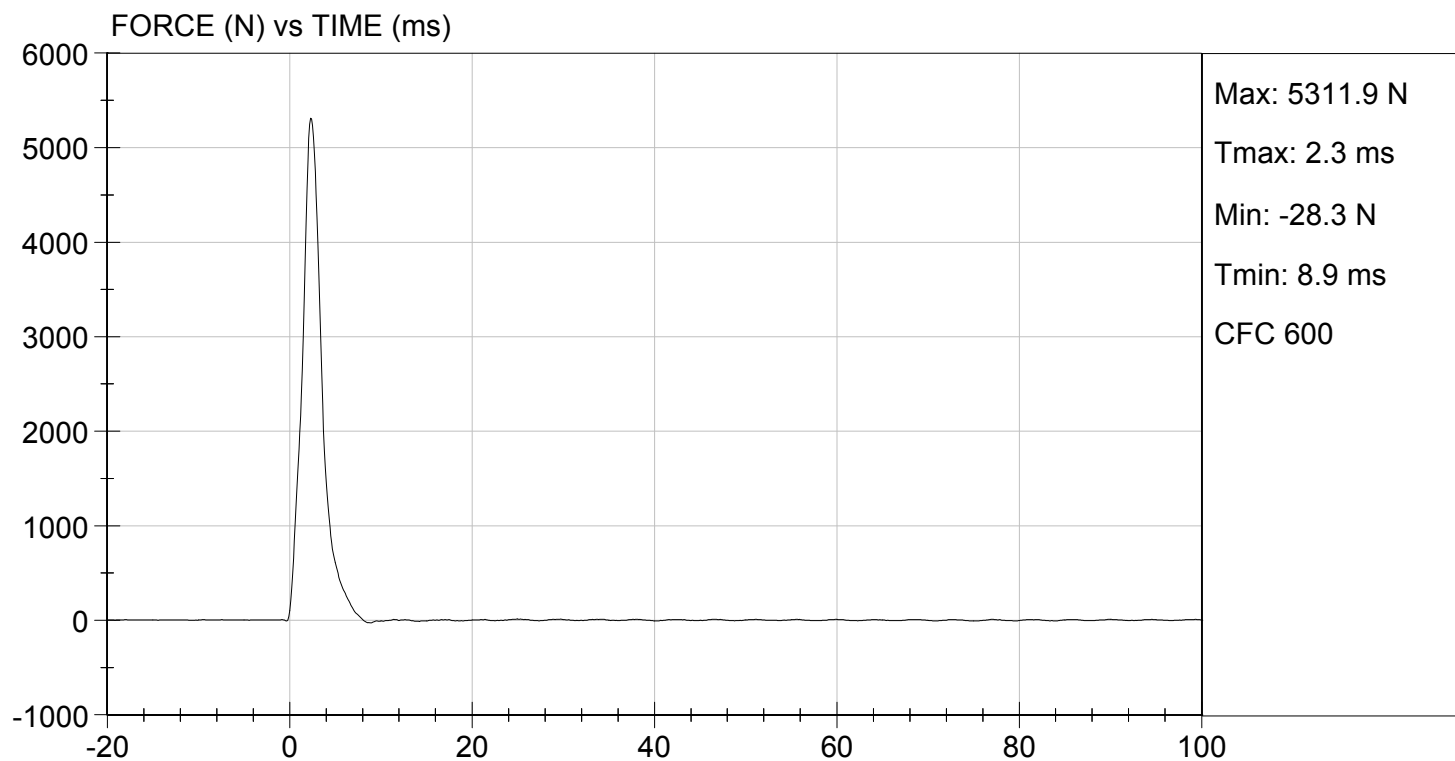
07/08/2013
Test Date


Approved By



TEST DESC: LEFT KNEE
VELOCITY: 6.83 ft/s, 2.08 m/s

TEST DATE: 07/08/2013
TEST #: D132196



MGA RESEARCH CORPORATION
HIP-FEMUR FLEXION TEST
HYBRID III 50TH PERCENTILE MALE

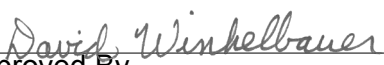
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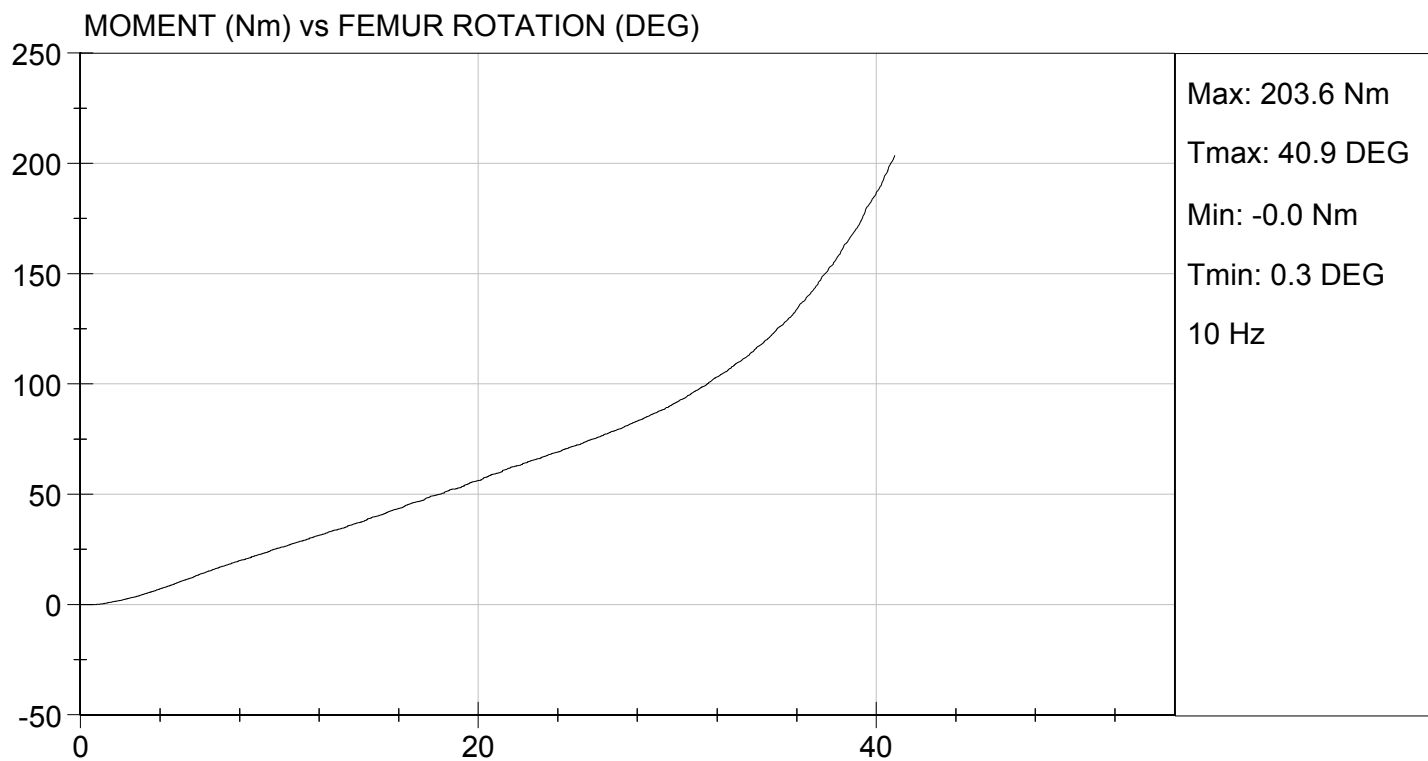
Test I.D: D132190

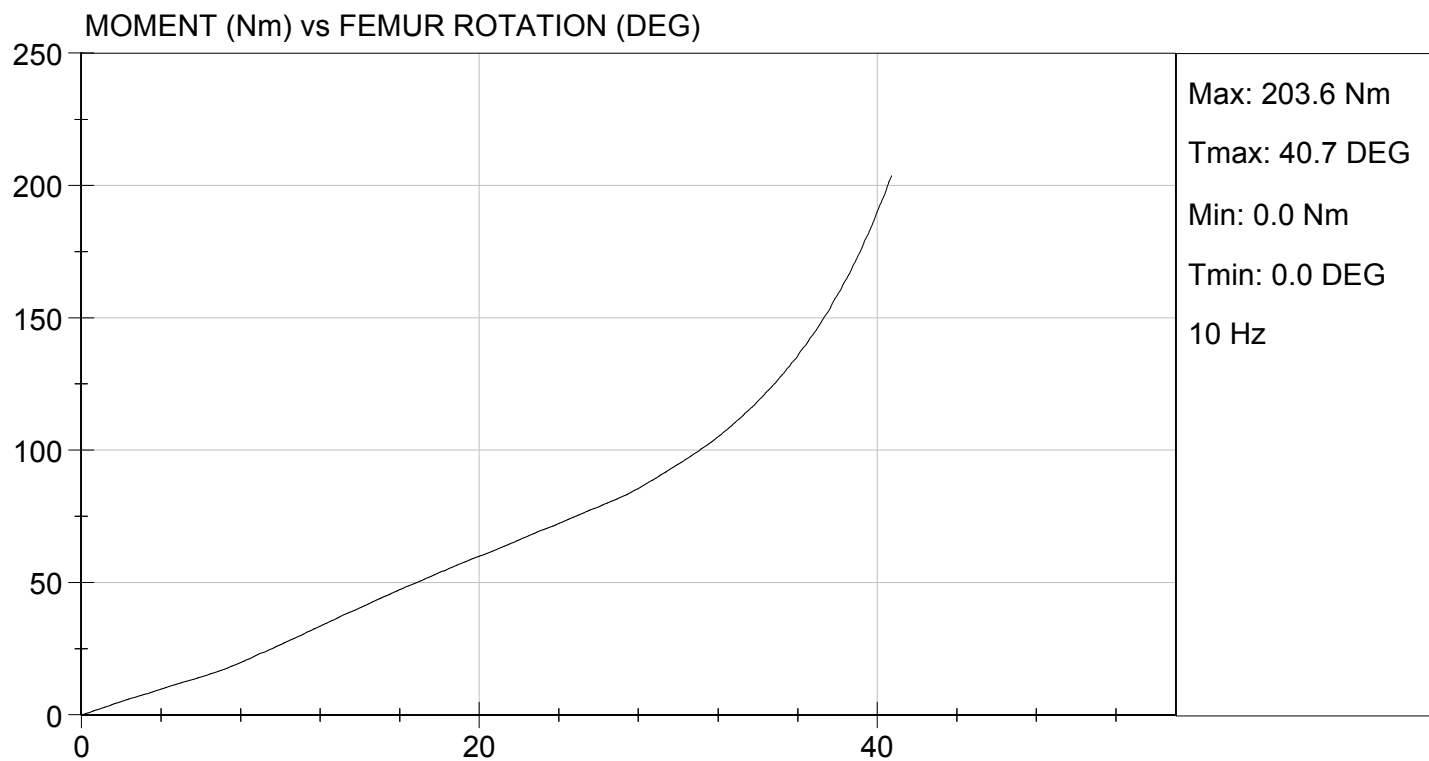
Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	20.9	20.9	Pass
Laboratory Relative Humidity	%	10 to 70	53	53	Pass
Rotation Rate	deg/s	5.0 to 10.0	6.1	6.2	Pass
30 Degrees	Nm	94.9 Nm Max	91.9	94.7	Pass
150 ft-lbf / 203.4 Nm	Deg	40.0 to 50.0 Degree Max Rotation	40.9	40.7	Pass
Overall Test Results					Pass


 Laboratory Technician

07/08/2013
 Test Date


 Approved By





Hybrid III, 5th External Measurements
SN: 138

HYBRID III, PART 572, SUBPART O EXTERNAL DIMENSIONS				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
A	TOTAL SITTING HEIGHT	Seat surface to highest point on top of the head.	774.7-800.1	785.1
B	SHOULDER PIVOT HEIGHT	Centerline of shoulder pivot bolt to the seat surface.	431.8-457.2	456.8
C	H-POINT HEIGHT	Reference	81.3-86.3	84.0
D	H-POINT LOCATION FROM BACKLINE	Reference	144.8-149.8	146.2
E	SHOULDER PIVOT FROM BACKLINE	Center of the shoulder clevis to the rear vertical surface of the fixture.	68.6-83.8	78.0
F	THIGH CLEARANCE	Measured at the highest point on the upper femur segment.	119.4-134.6	127.5
G	BACK OF ELBOW TO WRIST PIVOT	back of the elbow flesh to the wrist pivot in line with the elbow and wrist pivots	243.9-259.1	249.6
H	HEAD BACK TO BACKLINE	Back of Skull cap skin to seat rear vertical surface (Reference)	43.2-48.2	45.0
I	SHOULDER TO- ELBOW LENGTH	Measure from the highest point on top of the shoulder clevis to the lowest part of the flesh on the elbow in line with the elbow pivot bolt.	276.8-297.2	280.2
J	ELBOW REST HEIGHT	Measure from the flesh below the elbow pivot bolt to the seat surface.	182.8-203.2	201.9
K	BUTTOCK TO KNEE LENGTH	The forward most part of the knee flesh to the rear vertical surface of the fixture.	520.7-546.1	526.7
L	POPLITEAL HEIGHT	Seat surface to the plane of the horizontal plane of the bottom of the feet.	355.6-376.0	362.3
M	KNEE PIVOT HEIGHT	Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.	393.7-419.1	398.0
N	BUTTOCK POPLITEAL LENGTH	The rearmost surface of the lower leg to the same point on the rear surface of the buttocks used for dim. "K".	414-439.4	430.5

HYBRID III, SUBPART O EXTERNAL DIMENSIONS, continued				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
O	CHEST DEPTH WITHOUT JACKET	Measured 304.8 ± 5.1 mm above seat surface	175.3-190.5	184.6
P	FOOT LENGTH	Tip of toe to rear of heel	218.5-233.7	221.0
Q	STANDING HEIGHT	(THEORETICAL)	1501.1	N/A
R	BUTTOCK TO KNEE PIVOT LENGTH	The rear surface of the buttocks to the knee pivot bolt	457.2-482.6	472.6
S	HEAD BREADTH	The widest part of the head	137.1-147.3	141.9
T	HEAD DEPTH	Back of the head to the forehead	177.8-188.0	184.2
U	HIP BREADTH	The widest part of the hip	299.7-314.9	307.4
V	SHOULDER BREADTH	Outside edges of right and left shoulder clevises	350.5-365.7	360.5
W	FOOT BREADTH	The widest part of the foot	78.8-94.0	85.0
X	HEAD CIRCUMFERENCE	Measured at the point as in dim. "T"	528.3-548.7	546.2
Y	CHEST CIRCUMFERENCE (WITH CHEST JACKET)	Measured 345.4 ± 12.7 mm above seat surface	850.9-881.3	875.1
Z	WAIST CIRCUMFERENCE	Measured 165.1 ± 5.1 mm above seat surface	759.5-789.9	785.4
AA	REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE	Reference	332.7-358.1	345.4
BB	REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE	Reference	160.1-170.2	165.1

MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 5TH PERCENTILE

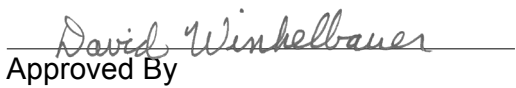
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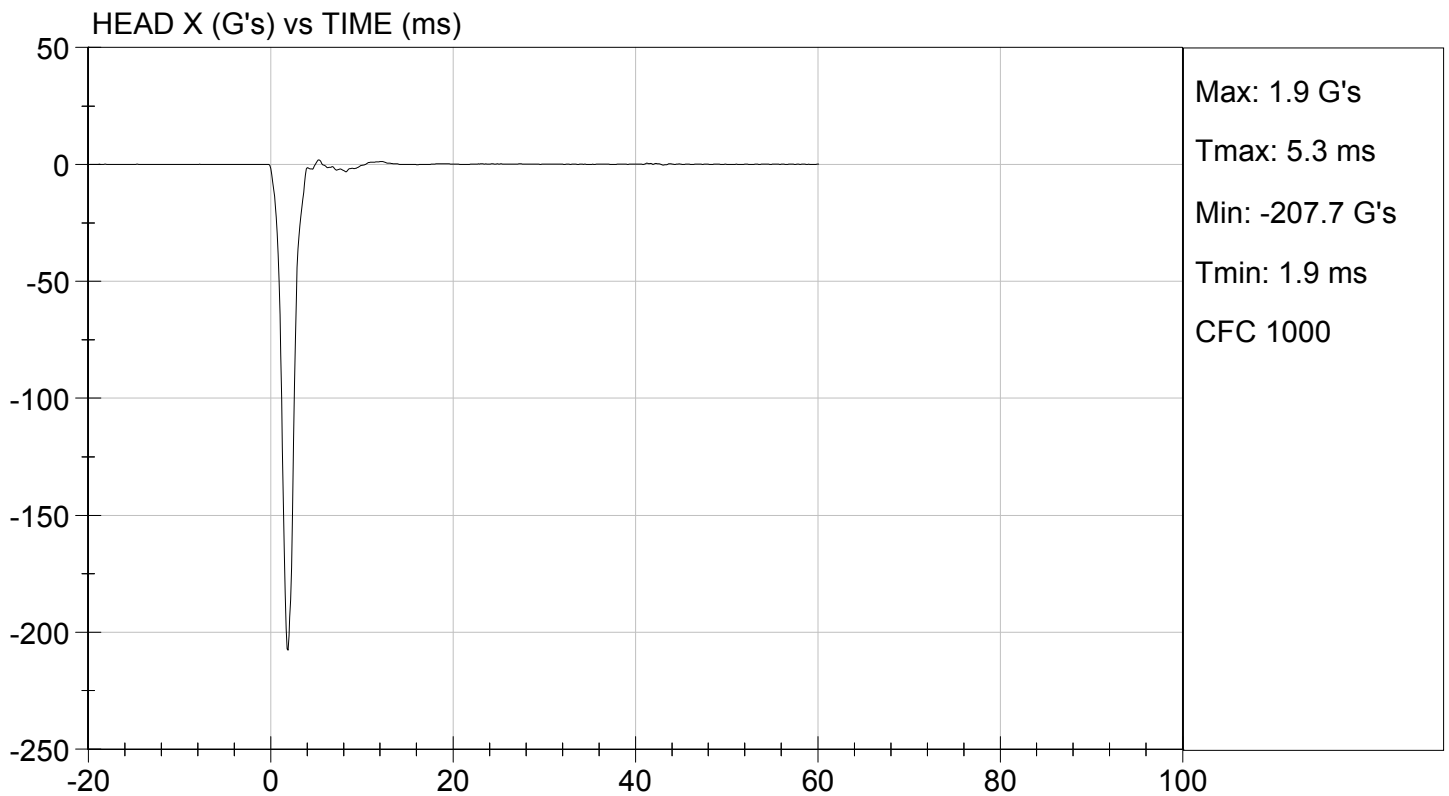
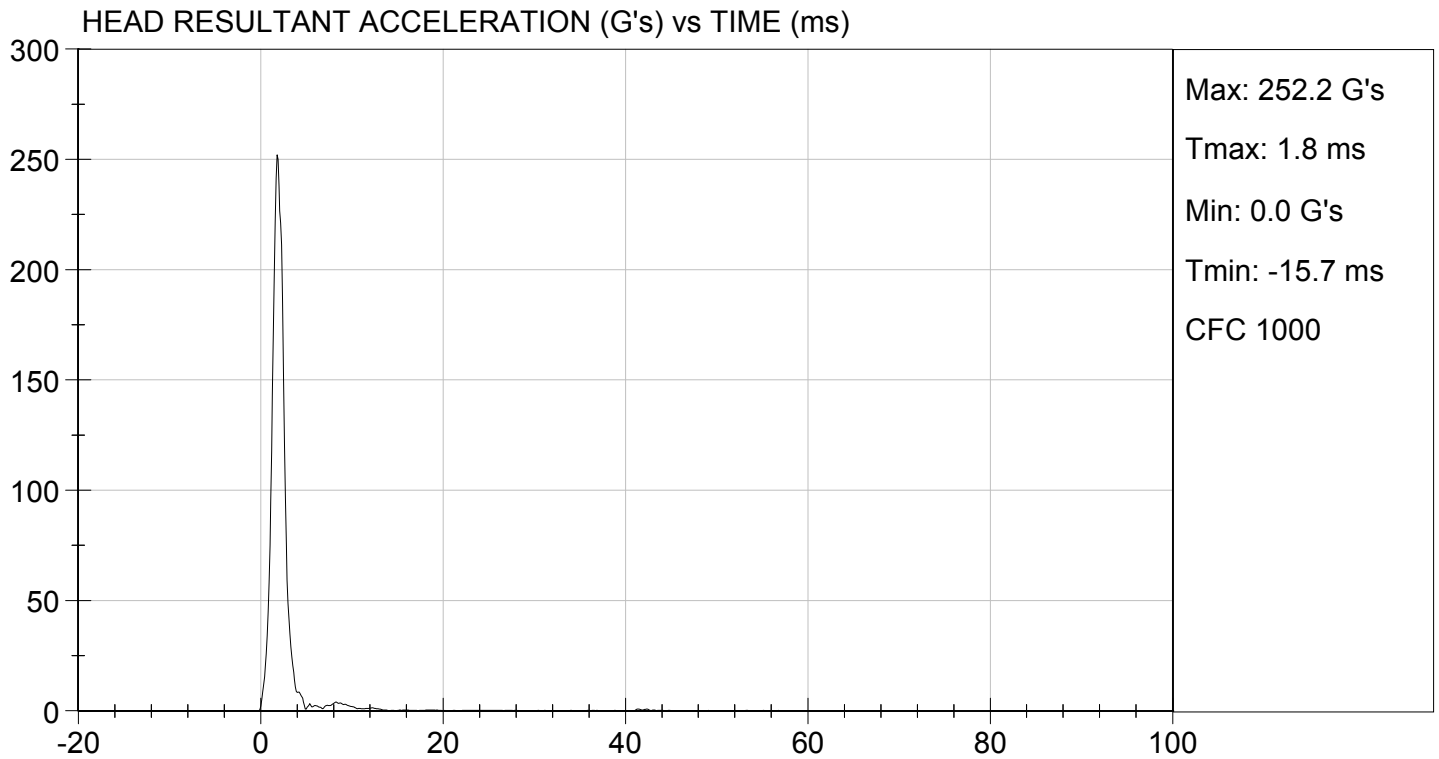
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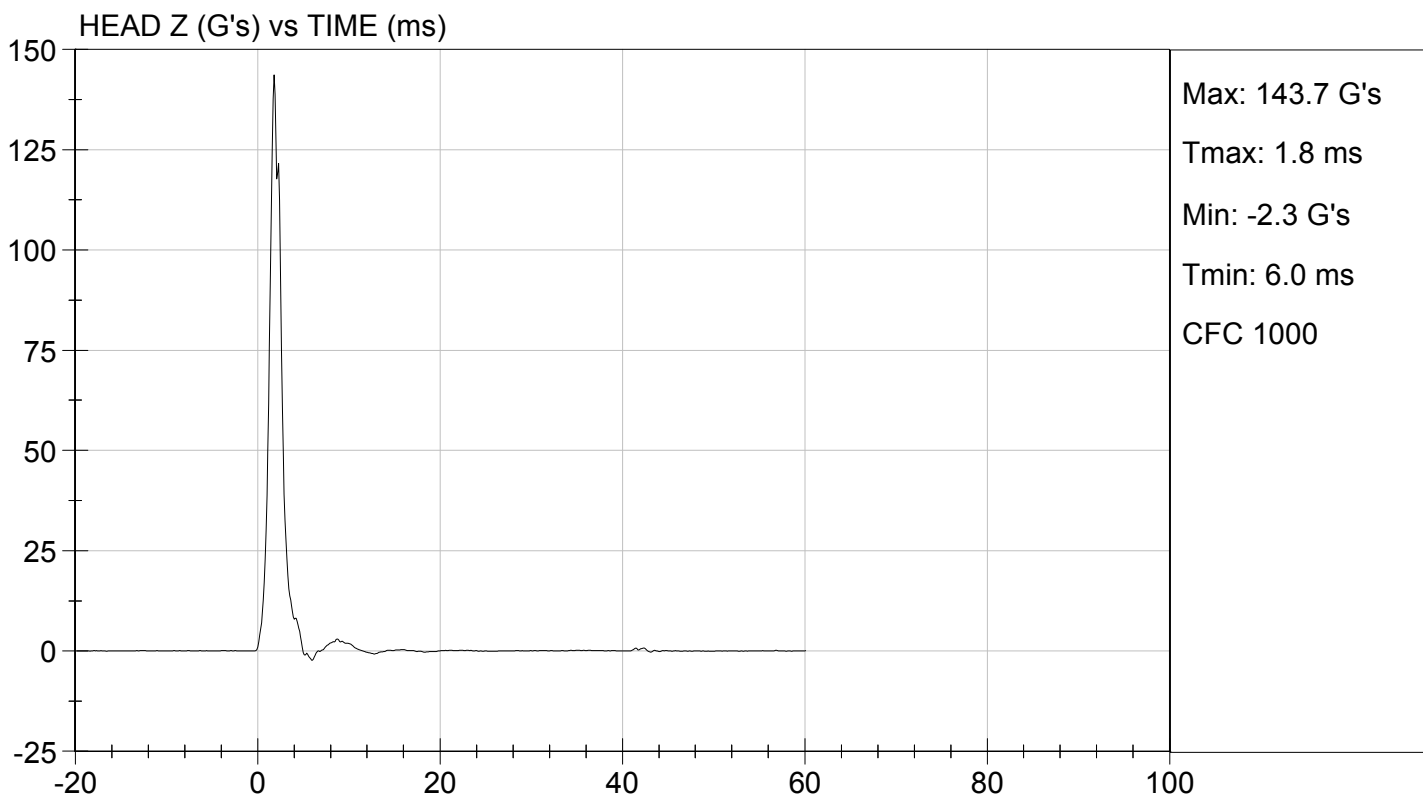
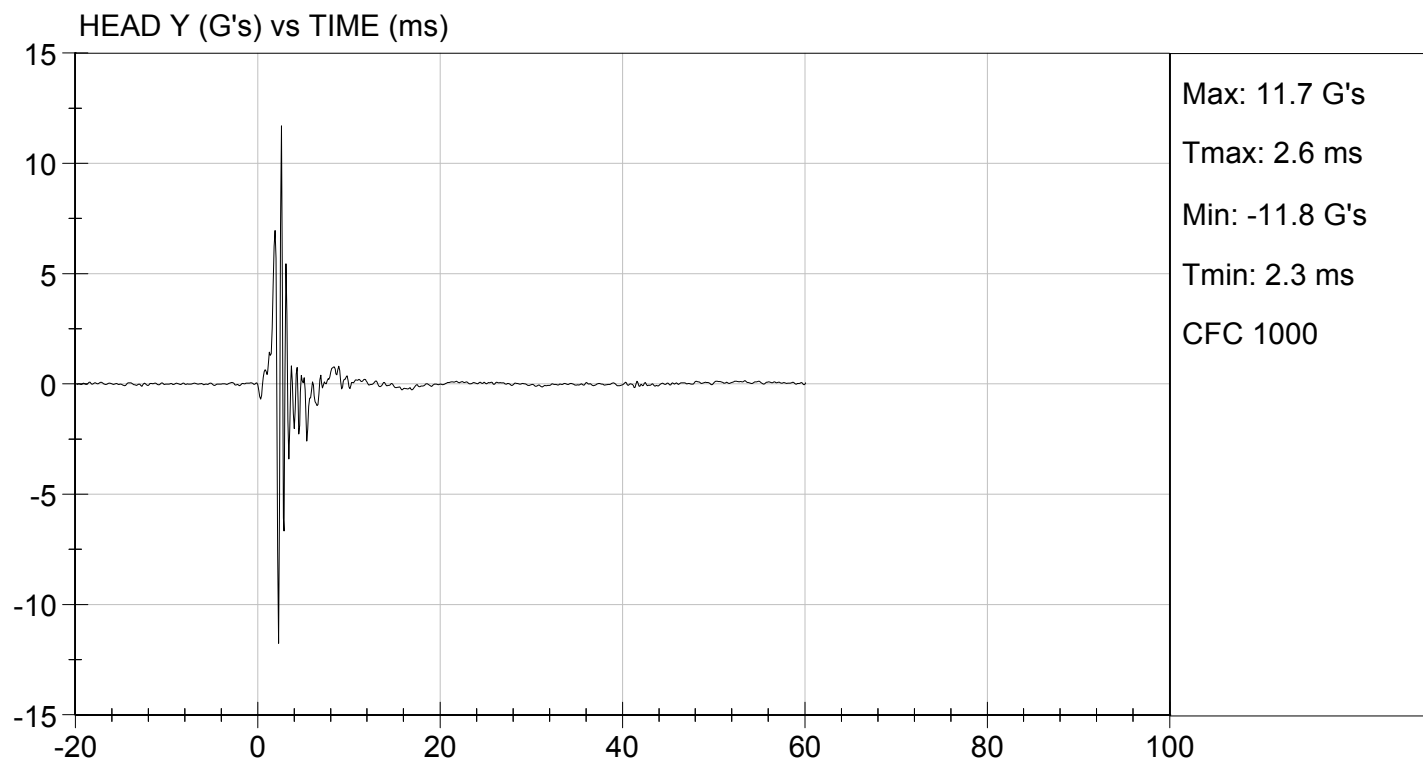
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	45	Pass
Peak Resultant Acceleration	G's	250 to 300	252	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-11.8	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass


Laboratory Technician

07/01/2013
Test Date


Approved By





MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test I.D: D132092

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.5	Pass
Laboratory Relative Humidity		%	10 to 70	45	Pass
Pendulum Speed		m/s	6.89 to 7.13	7.05	Pass
Pendulum Velocity	10 ms	m/s	2.1 to 2.5	2.4	Pass
	20 ms	m/s	4.0 to 5.0	4.5	Pass
	30 ms	m/s	5.8 to 7.0	6.2	Pass
D Plane Rotation	Max	deg	77 to 91	84	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	69 to 83	71	Pass
Positive Moment Time Curve Decay to 10 Nm		ms	80 to 100	87	Pass
Overall Results					Pass

Jessica Gall
 Laboratory Technician

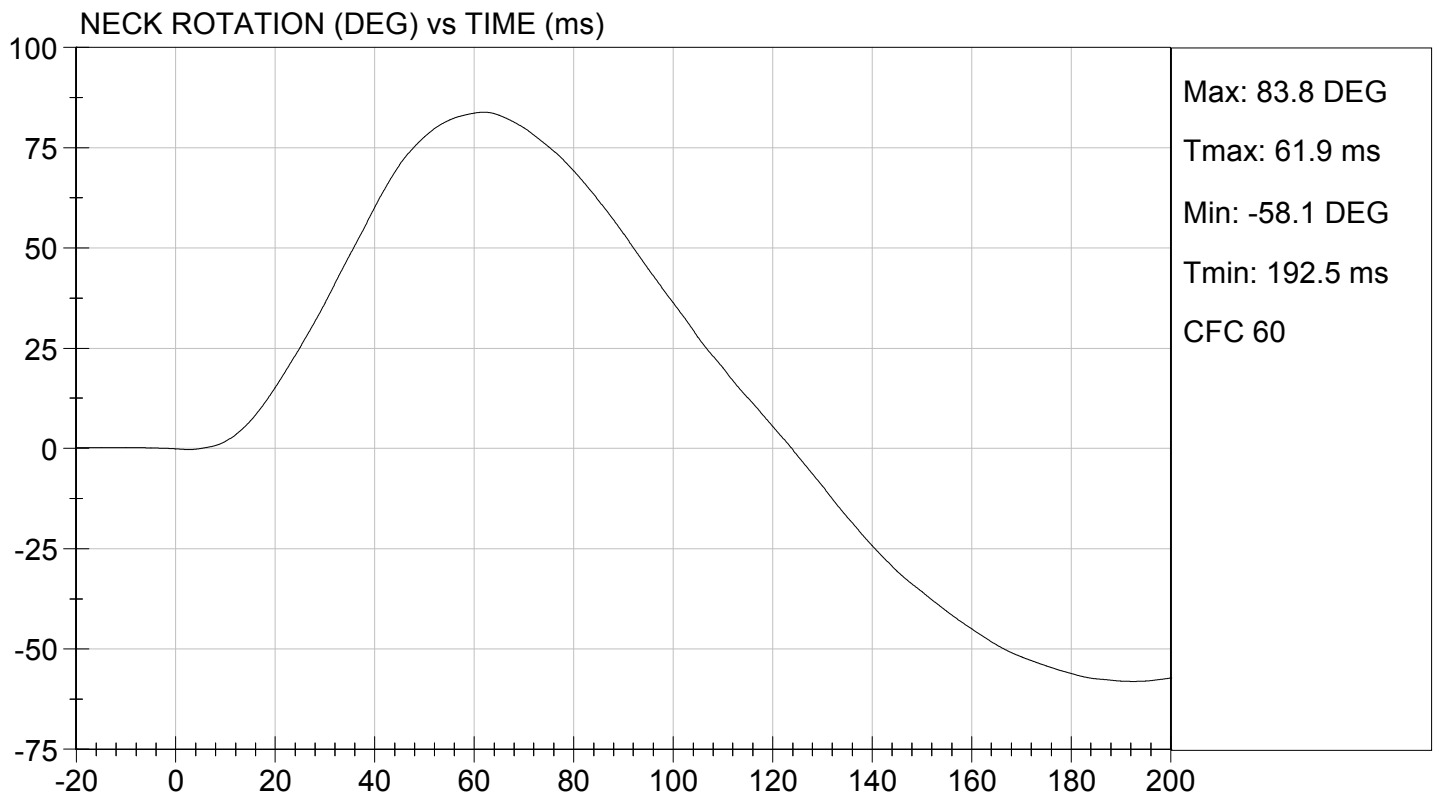
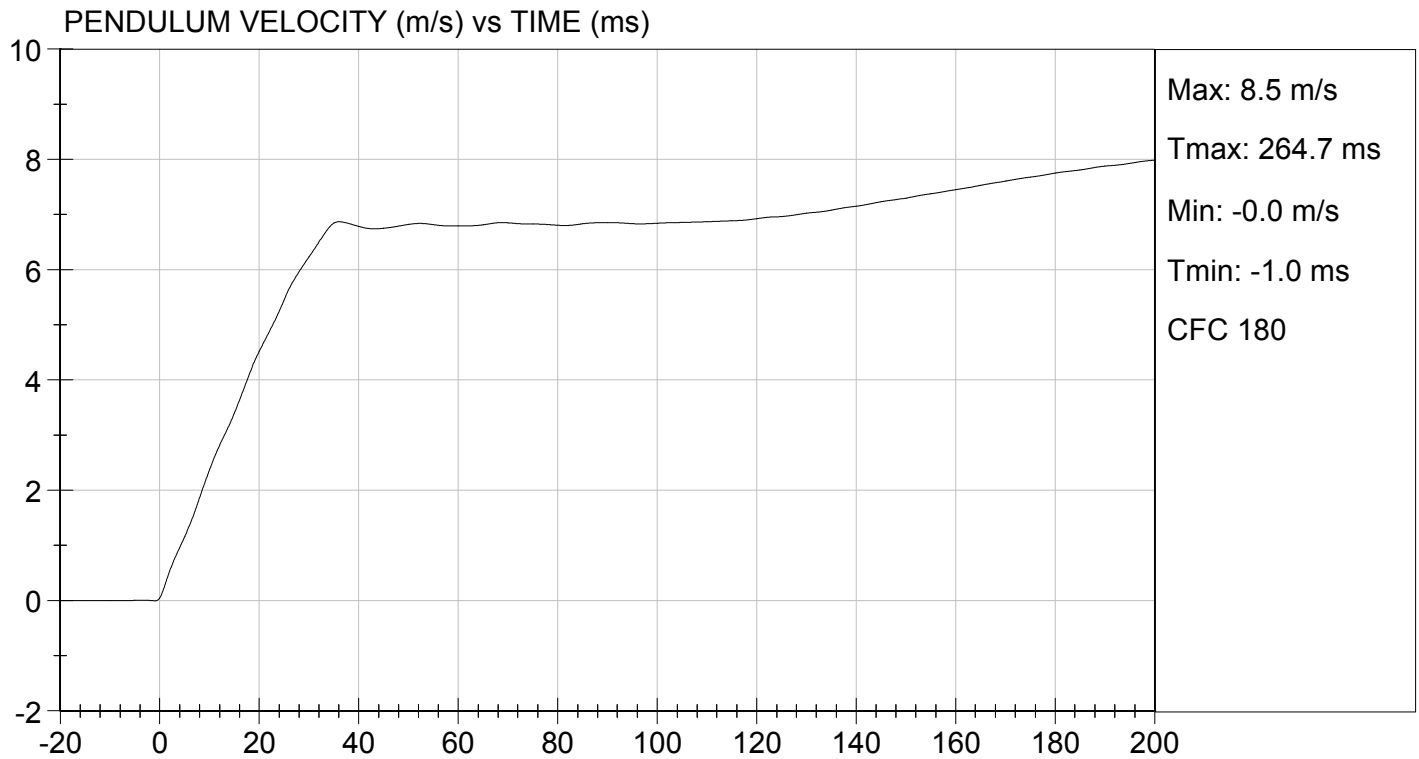
07/01/2013
 Test Date

David Winkelbauer
 Approved By



TEST DESC: NECK FLEXION
VELOCITY: 23.14 ft/s, 7.05 m/s

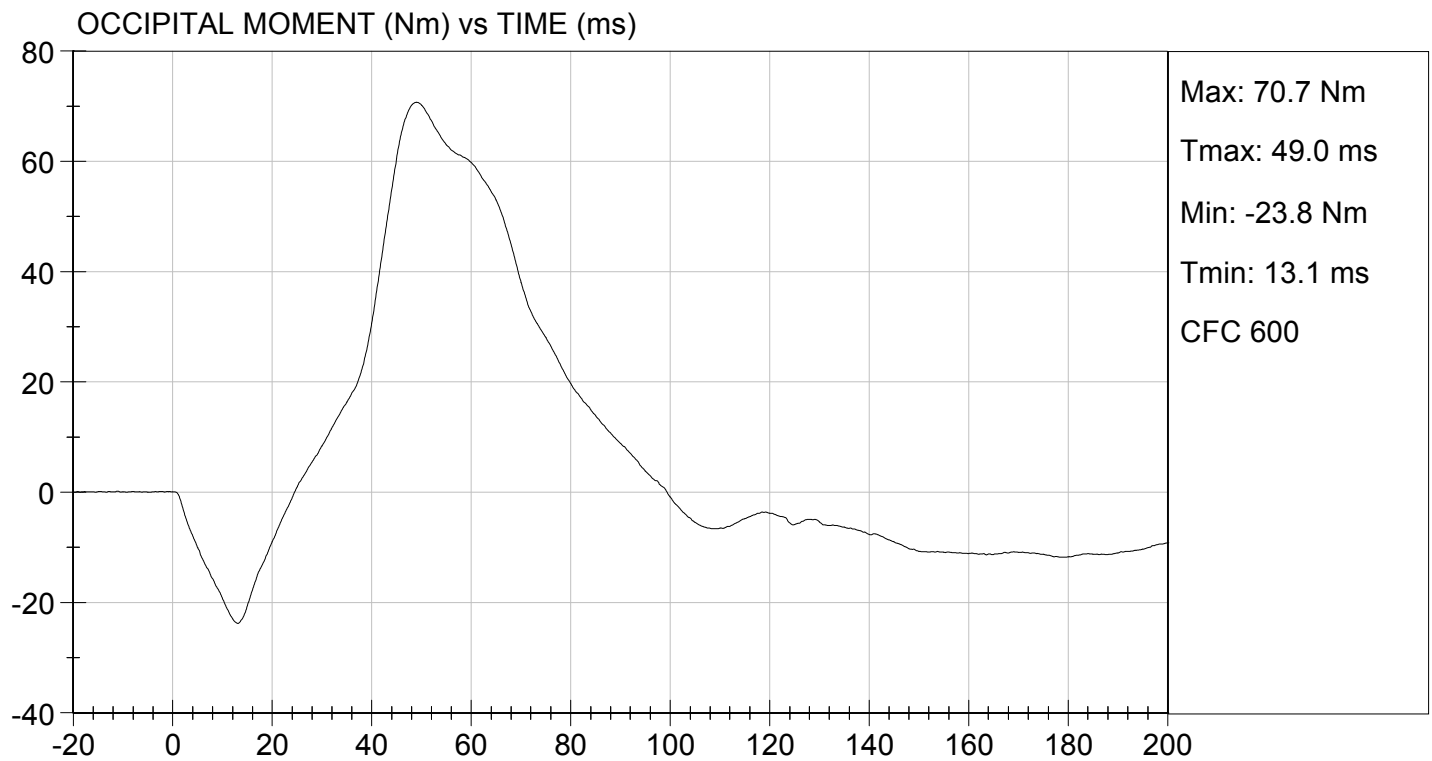
TEST DATE: 07/01/2013
TEST #: D132092





TEST DESC: NECK FLEXION
VELOCITY: 23.14 ft/s, 7.05 m/s

TEST DATE: 07/01/2013
TEST #: D132092



MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test I.D: D132093

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.5	Pass
Laboratory Relative Humidity		%	10 to 70	45	Pass
Pendulum Speed		m/s	5.95 to 6.19	6.12	Pass
Pendulum Velocity	10 ms	m/s	1.5 to 1.9	1.6	Pass
	20 ms	m/s	3.1 to 3.9	3.4	Pass
	30 ms	m/s	4.6 to 5.6	5.1	Pass
D Plane Rotation	Max	deg	99 to 114	108	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	-65 to -53	-56	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	99	Pass
Overall Results					Pass

Jessica Gall
Laboratory Technician

07/01/2013
Test Date

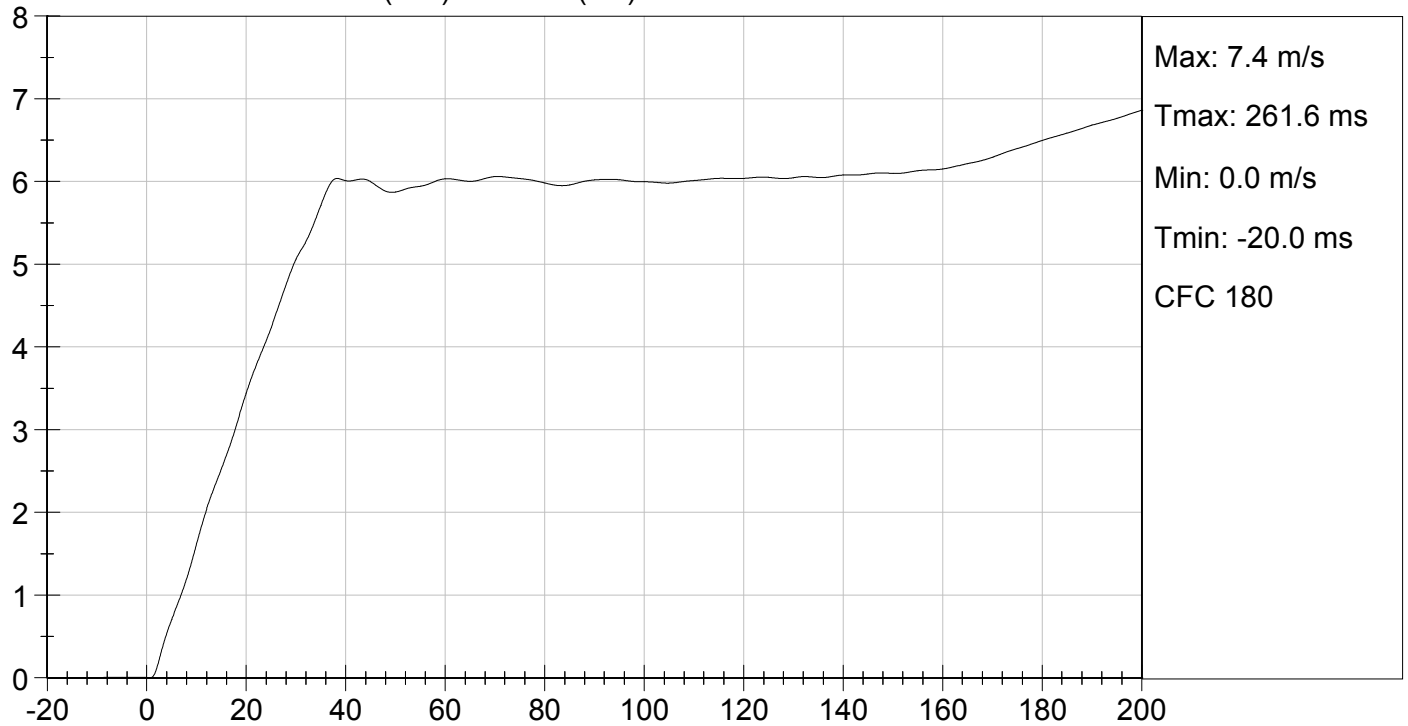
David Winkelbauer
Approved By



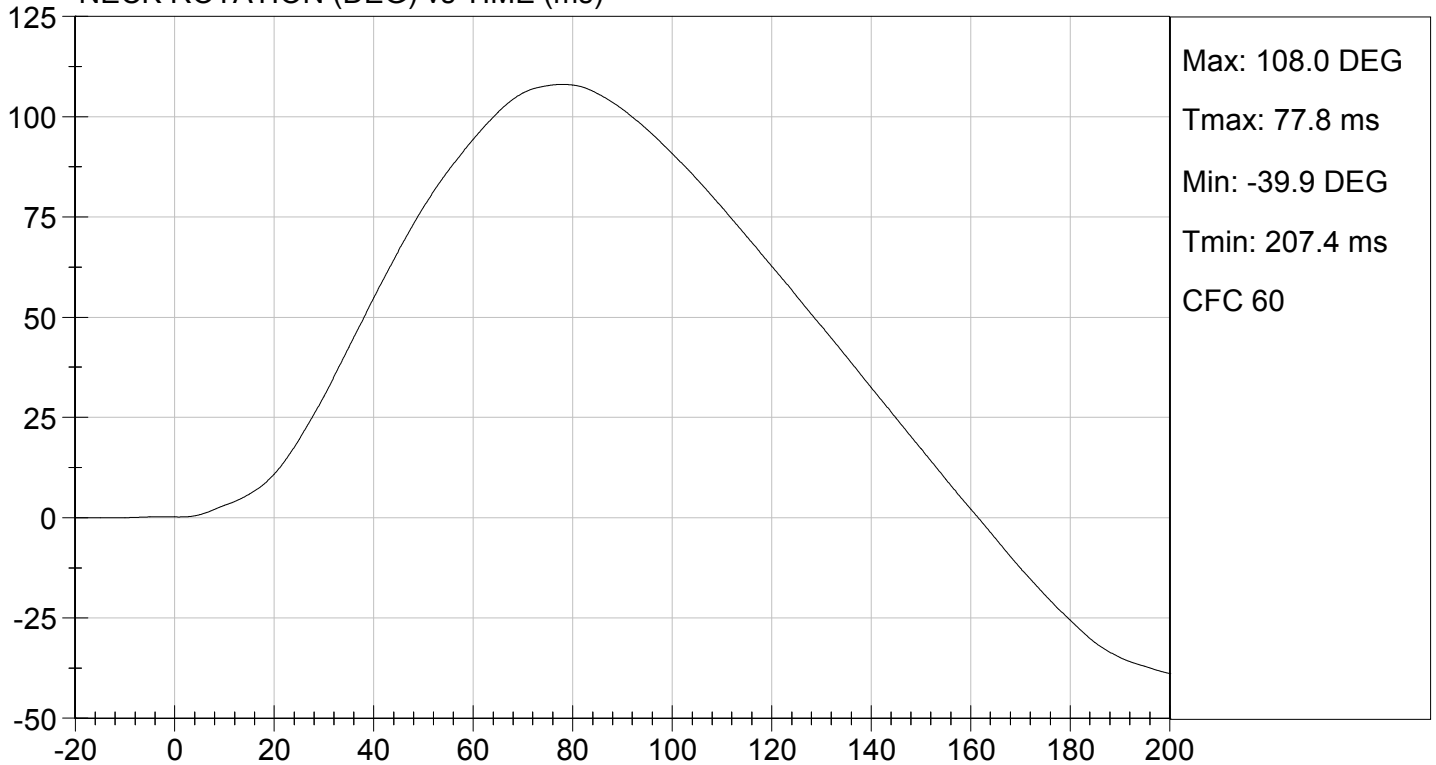
TEST DESC: NECK EXTENSION
VELOCITY: 20.08 ft/s, 6.12 m/s

TEST DATE: 07/01/2013
TEST #: D132093

PENDULUM VELOCITY (m/s) vs TIME (ms)



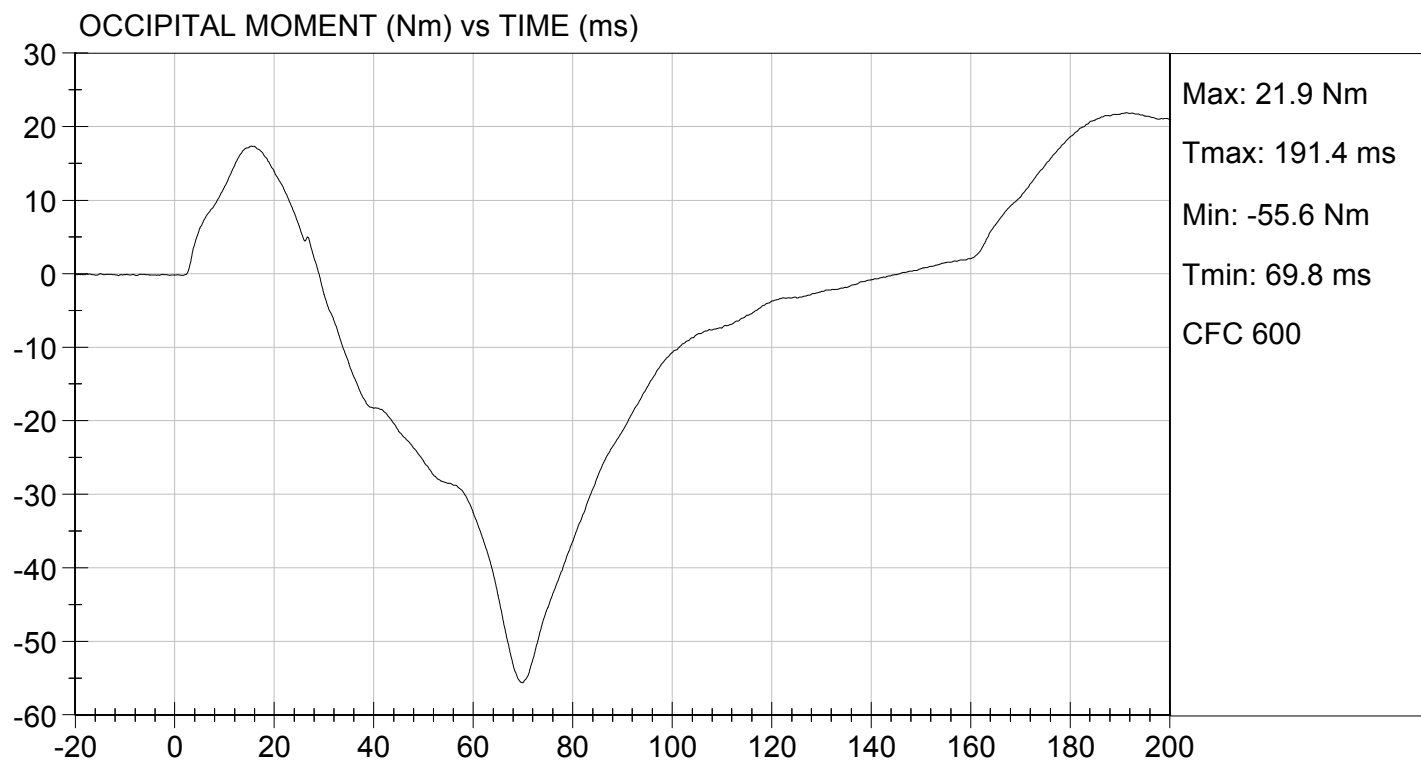
NECK ROTATION (DEG) vs TIME (ms)





TEST DESC: NECK EXTENSION
VELOCITY: 20.08 ft/s, 6.12 m/s

TEST DATE: 07/01/2013
TEST #: D132093

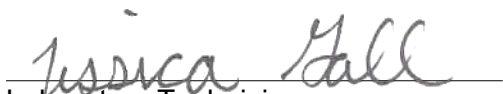


MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test I.D: D132094

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.1	Pass
Relative Humidity	%	10 to 70	42	Pass
Probe Speed	m/s	6.59 to 6.83	6.77	Pass
Peak Deflection	mm	50 to 58	57	Pass
Peak Resistive Force w/in Deflection Corridor	N	3900 to 4400	3940	Pass
Internal Hysteresis	%	69 to 85	69	Pass
Peak Force 18 mm - 50 mm	N	<= 4600	3810	Pass
Overall Test Results				Pass


Laboratory Technician

07/01/2013

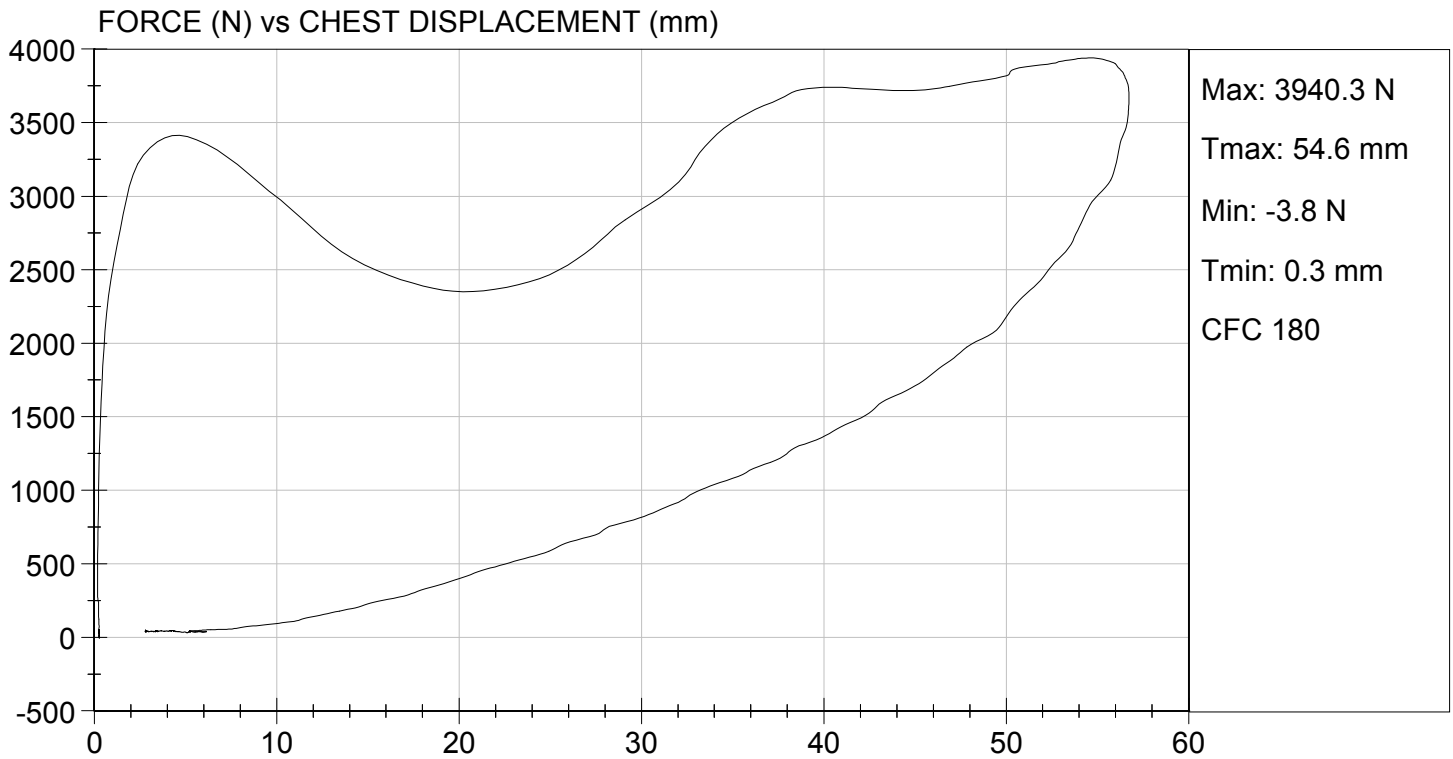
Test Date


Approved By



TEST DESC: THORAX IMPACT
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 07/01/2013
TEST #: D132094



MGA RESEARCH CORPORATION

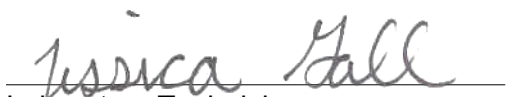
RIGHT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test I.D: D132095

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	41	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	N	3450 to 4060	3722	Pass
Overall Test Results				Pass


Laboratory Technician

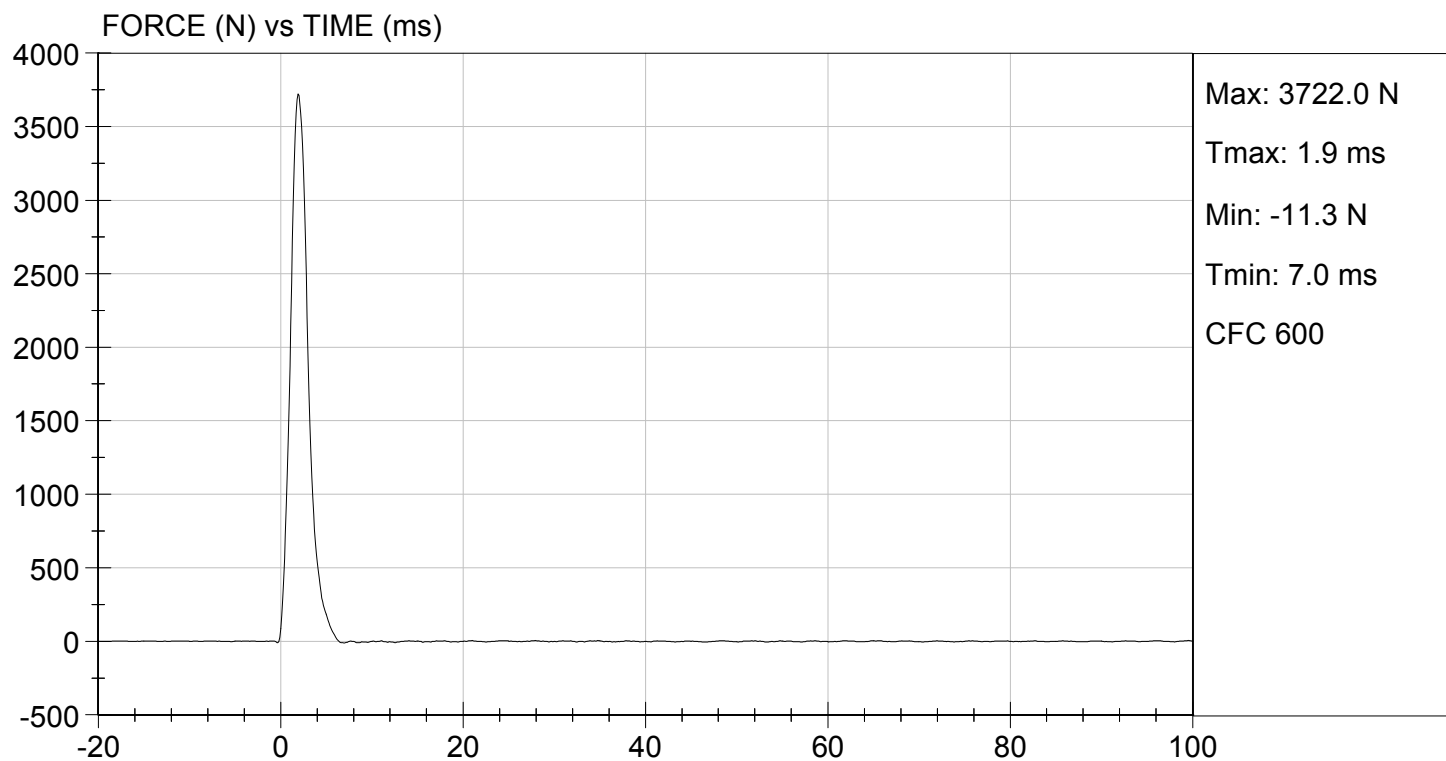
07/01/2013
Test Date


Approved By



TEST DESC: RIGHT KNEE
VELOCITY: 6.97 ft/s, 2.12 m/s

TEST DATE: 07/01/2013
TEST #: D132095



MGA RESEARCH CORPORATION

**LEFT KNEE IMPACT TEST
HYBRID III 5TH PERCENTILE**

ATD Serial No: 138

Test I.D: D132096

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	41	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	N	3450 to 4060	3663	Pass
Overall Test Results				Pass


Laboratory Technician

07/01/2013

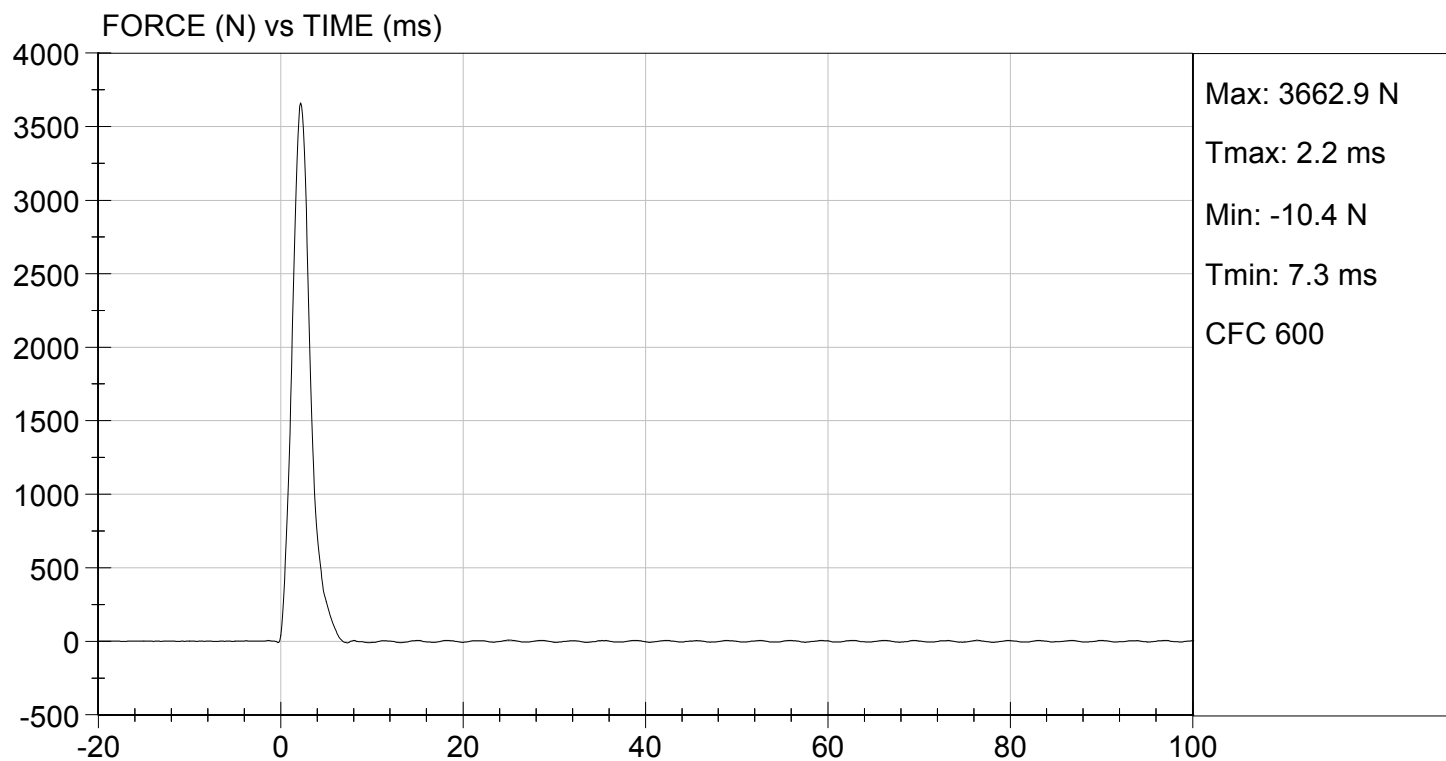
Test Date


Approved By



TEST DESC: LEFT KNEE
VELOCITY: 6.97 ft/s, 2.12 m/s

TEST DATE: 07/01/2013
TEST #: D132096



MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138

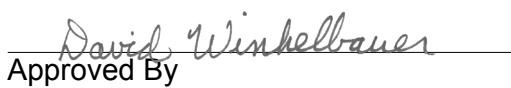
Test I.D: D132097

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	41	Pass
Initial Angle	deg	0 to 20	19	Pass
Return Angle	deg	+/- 8	3	Pass
Force at 45 deg	N	320 to 390	370	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.9	Pass
Overall Result				Pass


Laboratory Technician

07/01/2013

Test Date

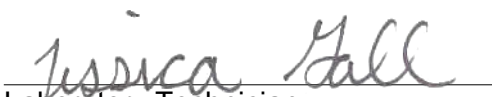

Approved By

MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 138

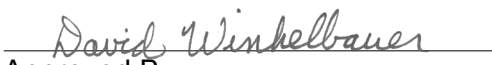
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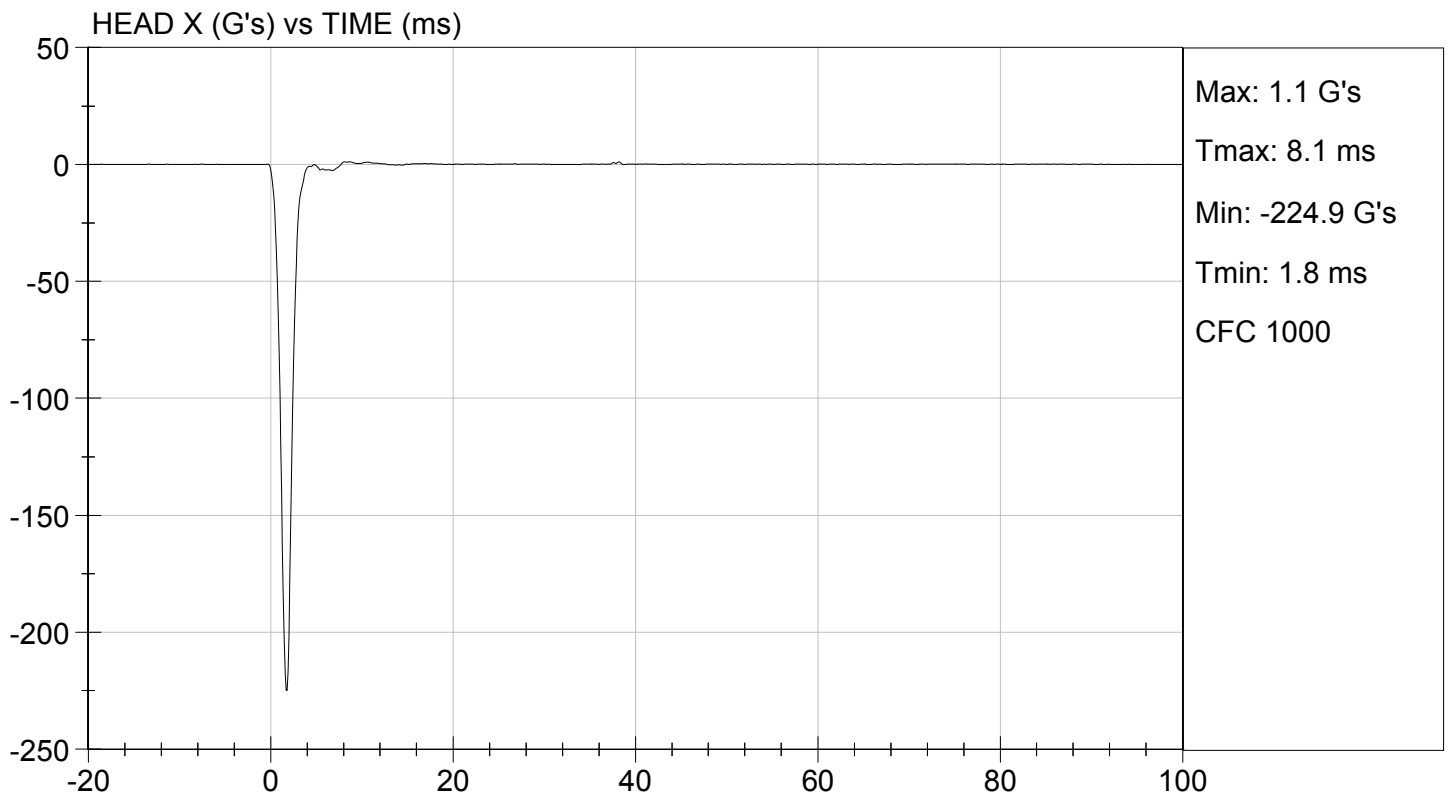
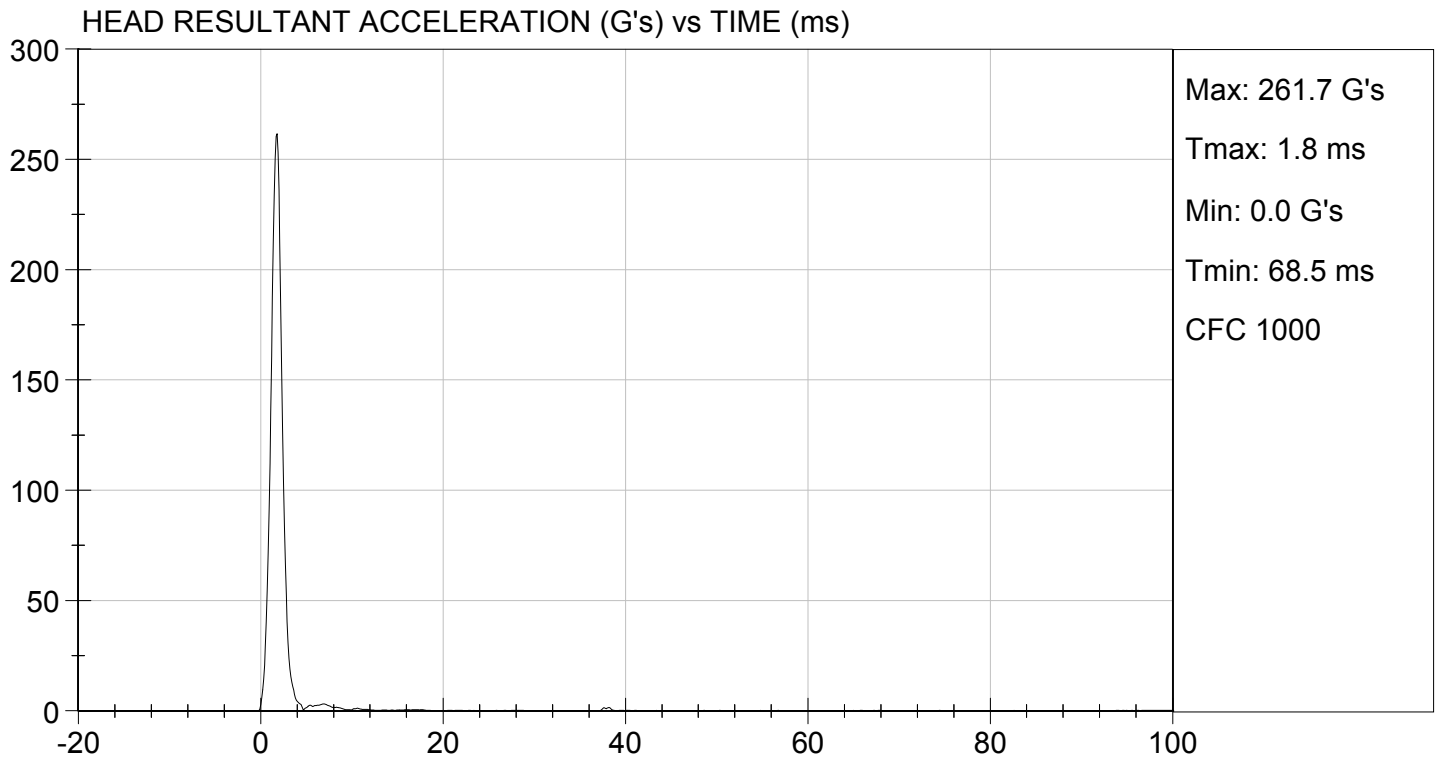
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.0	Pass
Laboratory Relative Humidity	%	10 to 70	53	Pass
Peak Resultant Acceleration	G's	250 to 300	262	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-11.6	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
			Overall Test Results	Pass

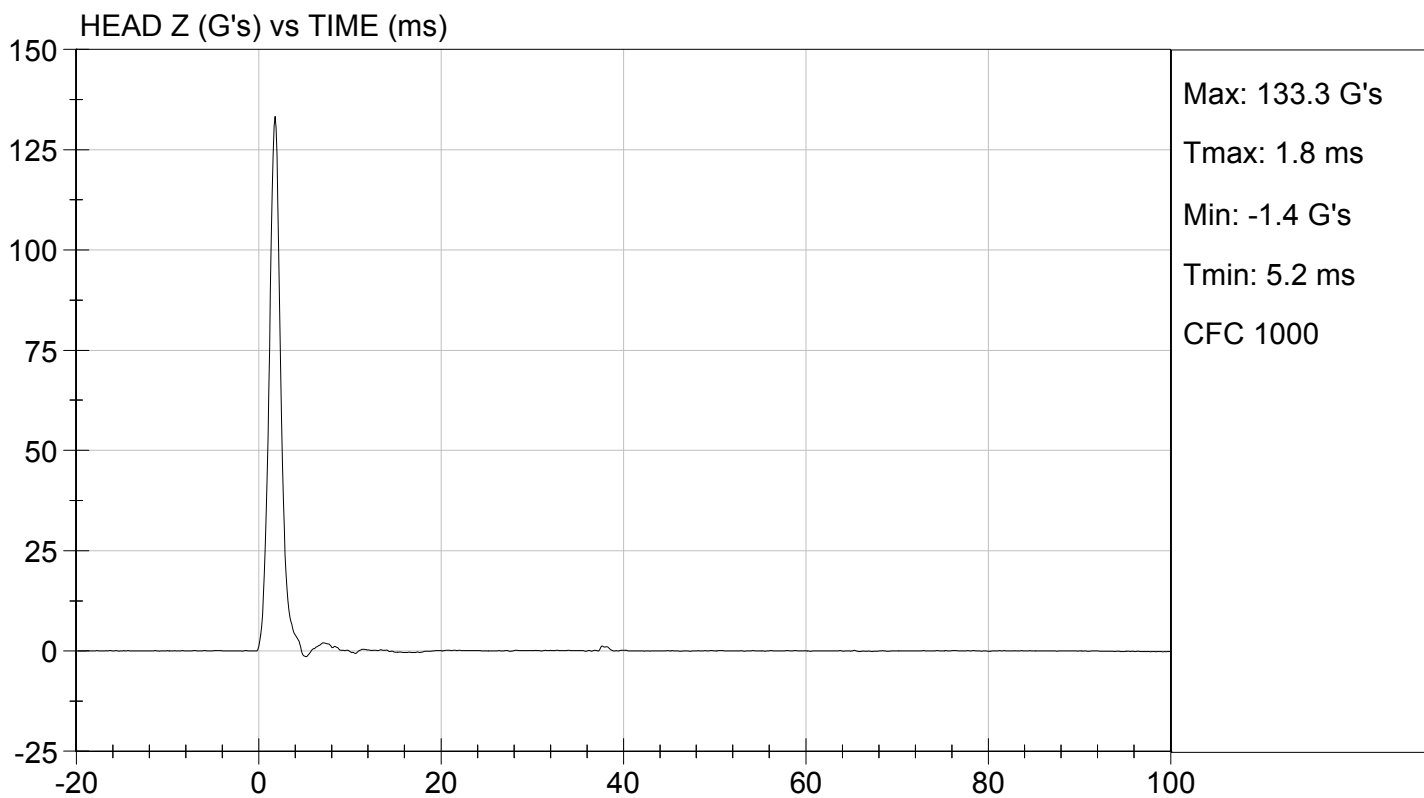
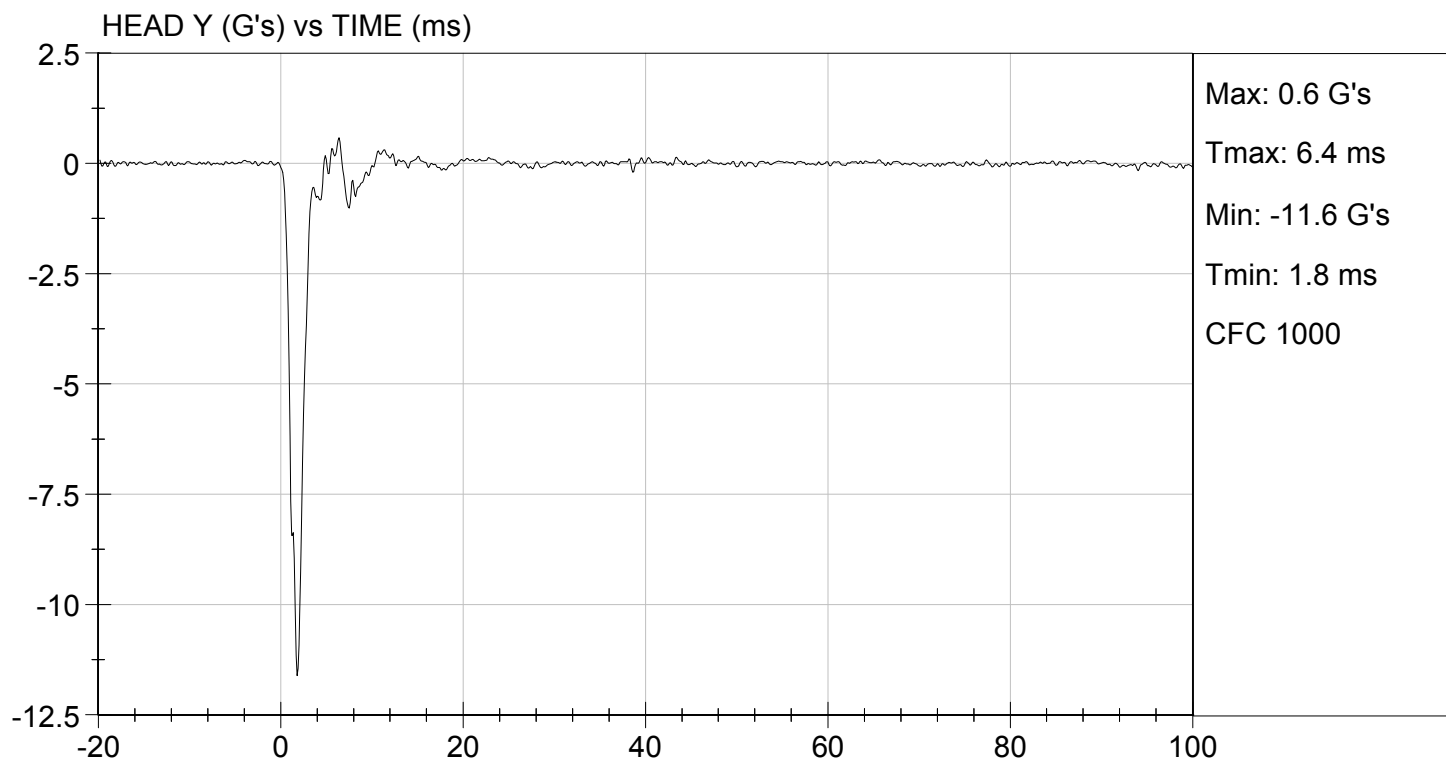

Laboratory Technician

07/08/2013

Test Date


Approved By





MGA RESEARCH CORPORATION

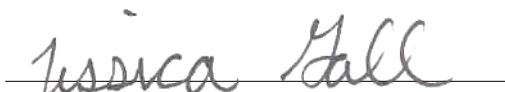
NECK FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test I.D: D132202

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.0	Pass
Laboratory Relative Humidity		%	10 to 70	50	Pass
Pendulum Speed		m/s	6.89 to 7.13	7.05	Pass
Pendulum Velocity	10 ms	m/s	2.1 to 2.5	2.4	Pass
	20 ms	m/s	4.0 to 5.0	4.6	Pass
	30 ms	m/s	5.8 to 7.0	6.4	Pass
D Plane Rotation	Max	deg	77 to 91	84	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	69 to 83	70	Pass
Positive Moment Time Curve Decay to 10 Nm		ms	80 to 100	85	Pass
Overall Results					Pass


 Laboratory Technician

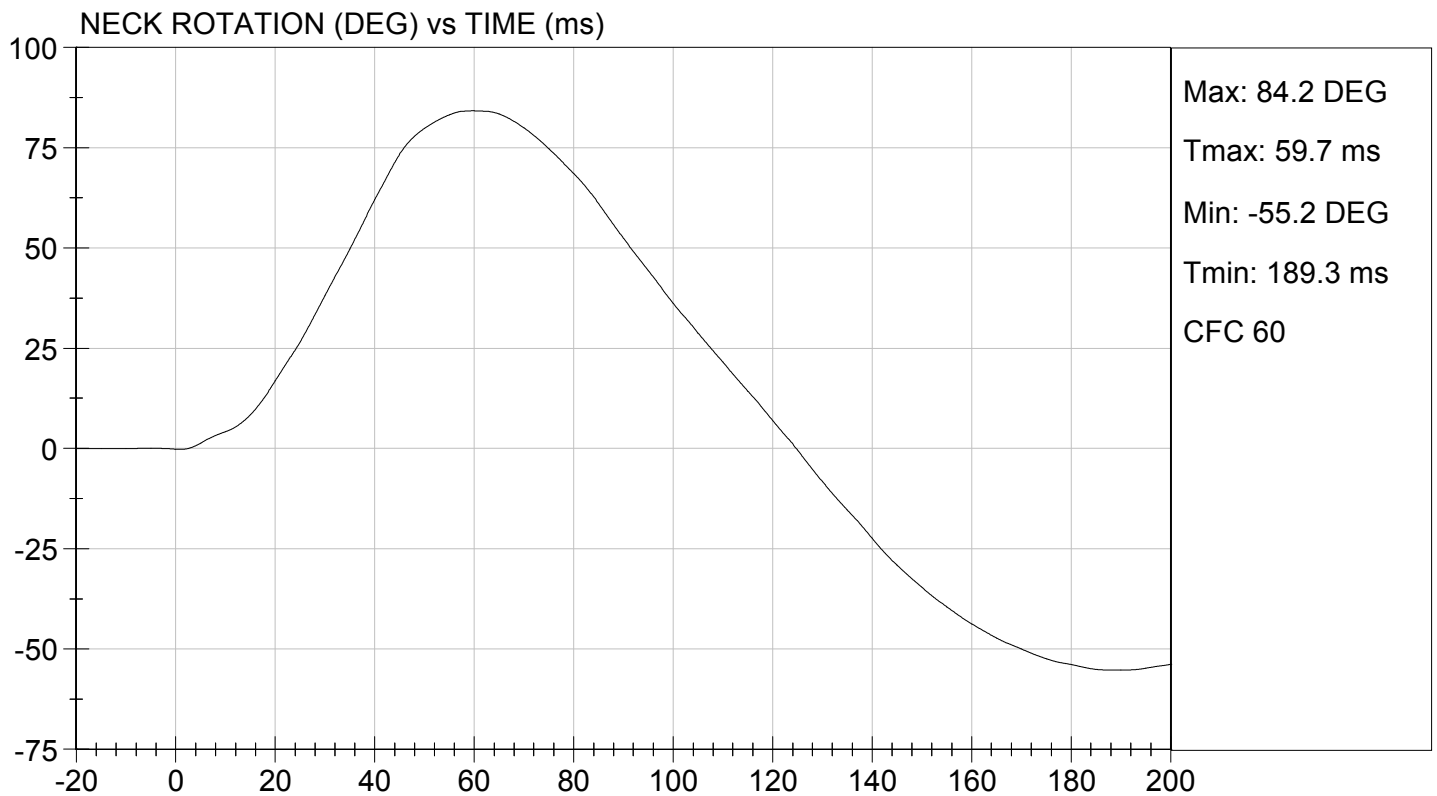
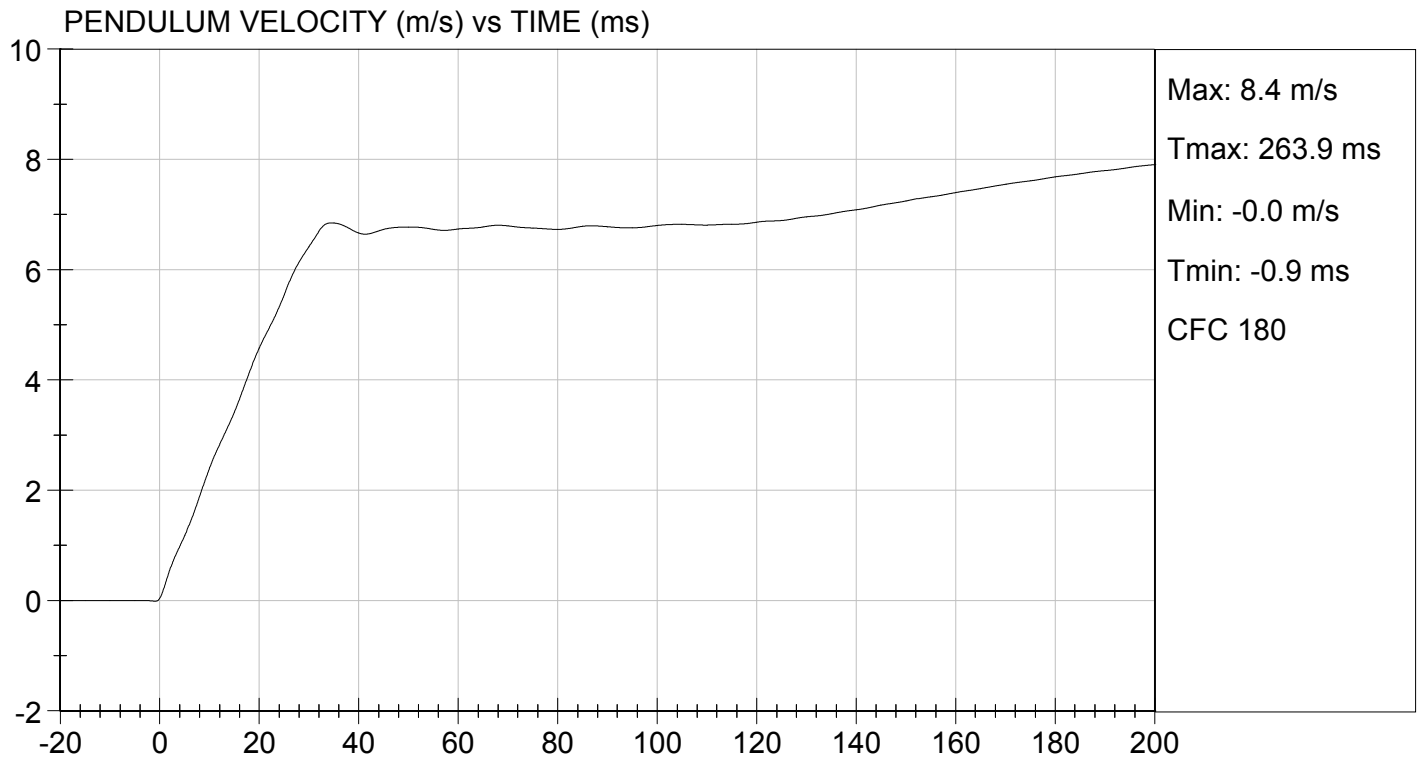
07/08/2013
 Test Date


 Approved By



TEST DESC: NECK FLEXION
VELOCITY: 23.14 ft/s, 7.05 m/s

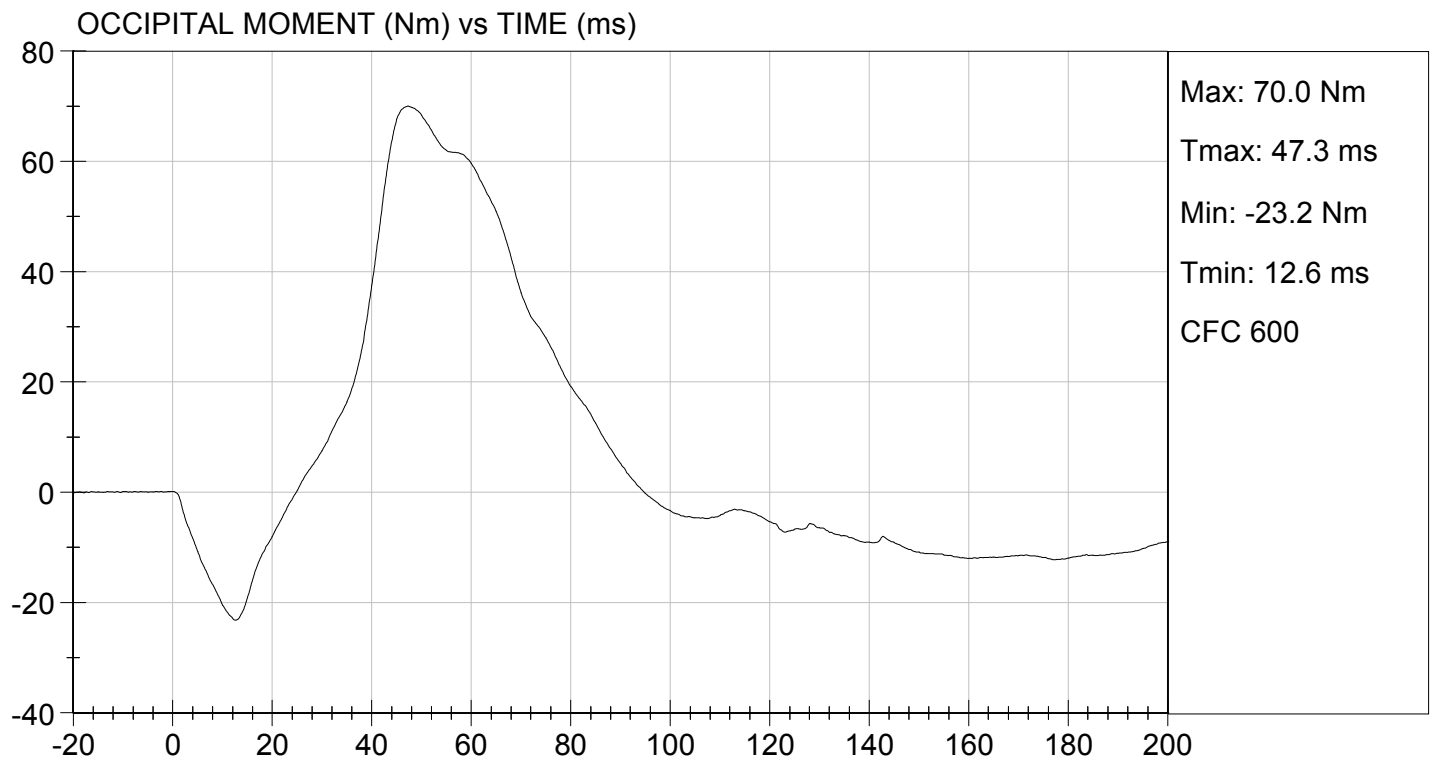
TEST DATE: 07/08/2013
TEST #: D132202





TEST DESC: NECK FLEXION
VELOCITY: 23.14 ft/s, 7.05 m/s

TEST DATE: 07/08/2013
TEST #: D132202



MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 5TH PERCENTILE

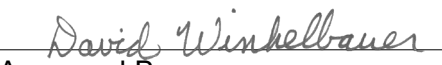
ATD Serial No: 138

Test I.D: D132203

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.0	Pass
Laboratory Relative Humidity		%	10 to 70	50	Pass
Pendulum Speed		m/s	5.95 to 6.19	6.12	Pass
Pendulum Velocity	10 ms	m/s	1.5 to 1.9	1.6	Pass
	20 ms	m/s	3.1 to 3.9	3.4	Pass
	30 ms	m/s	4.6 to 5.6	4.9	Pass
D Plane Rotation	Max	deg	99 to 114	107	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	-65 to -53	-56	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	100	Pass
Overall Results					Pass


Laboratory Technician

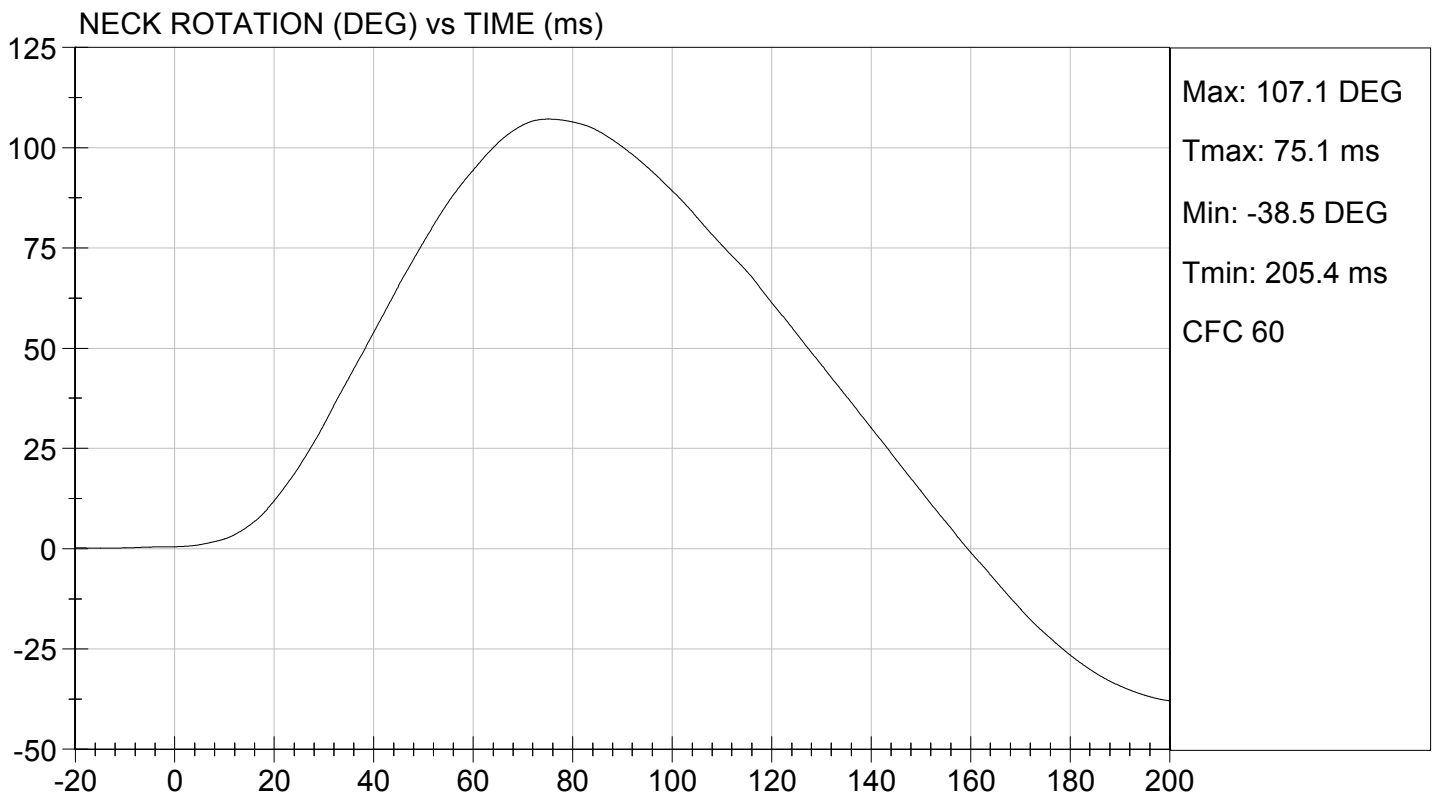
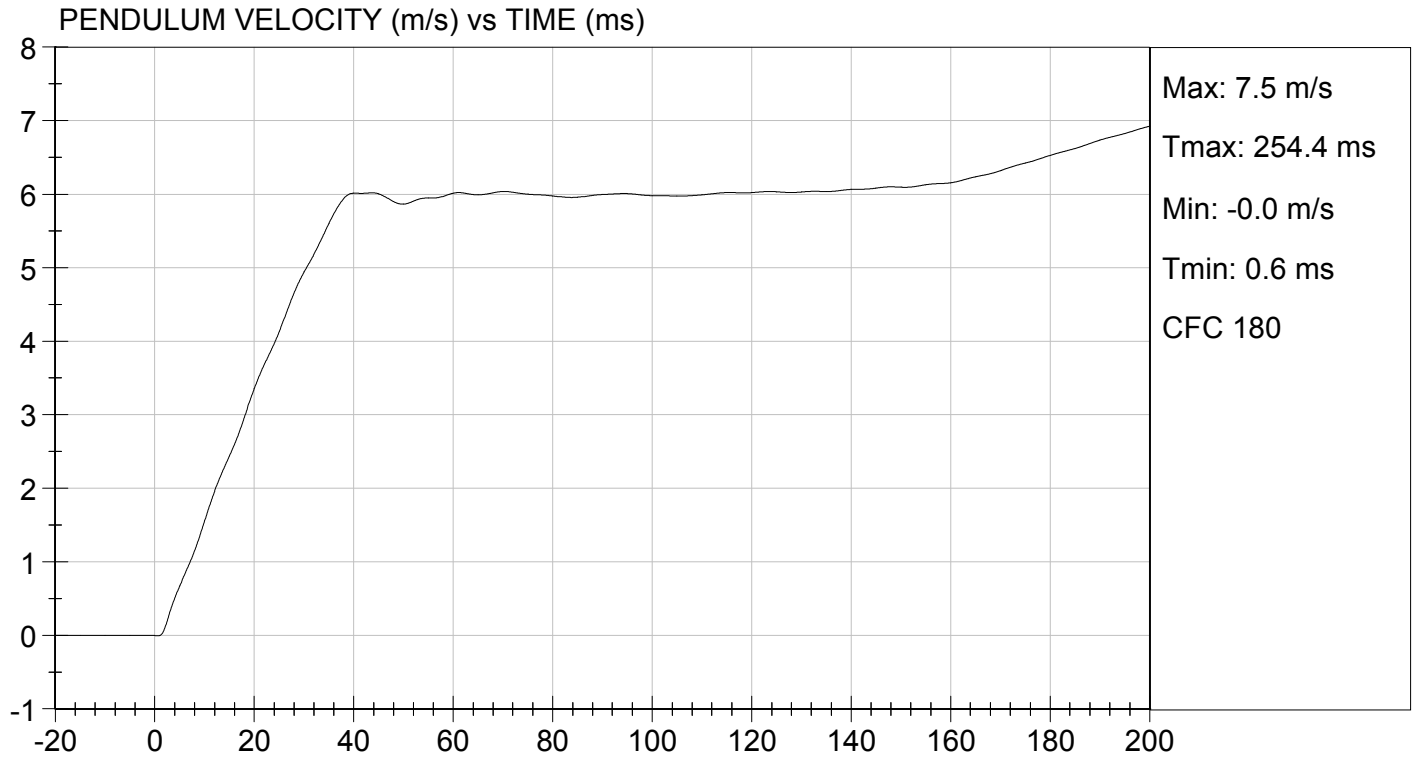
07/08/2013
Test Date


Approved By



TEST DESC: NECK EXTENSION
VELOCITY: 20.08 ft/s, 6.12 m/s

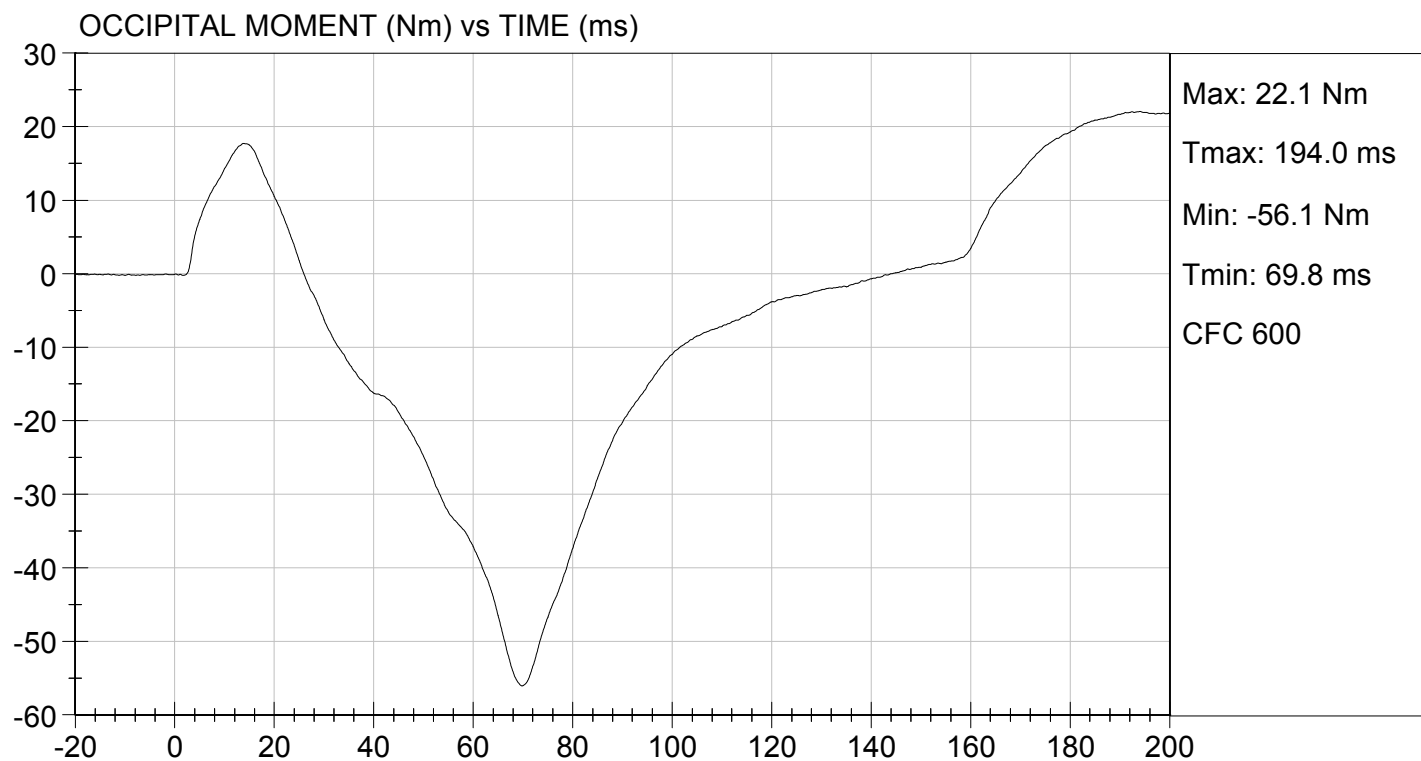
TEST DATE: 07/08/2013
TEST #: D132203





TEST DESC: NECK EXTENSION
VELOCITY: 20.08 ft/s, 6.12 m/s

TEST DATE: 07/08/2013
TEST #: D132203



MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 5TH PERCENTILE

ATD Serial No: 138

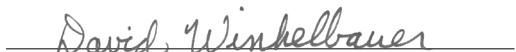
Test I.D: D132204

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.3	Pass
Relative Humidity	%	10 to 70	55	Pass
Probe Speed	m/s	6.59 to 6.83	6.77	Pass
Peak Deflection	mm	50 to 58	54	Pass
Peak Resistive Force w/in Deflection Corridor	N	3900 to 4400	4084	Pass
Internal Hysteresis	%	69 to 85	71	Pass
Peak Force 18 mm - 50 mm	N	<= 4600	4084	Pass
Overall Test Results				Pass


Laboratory Technician

07/09/2013

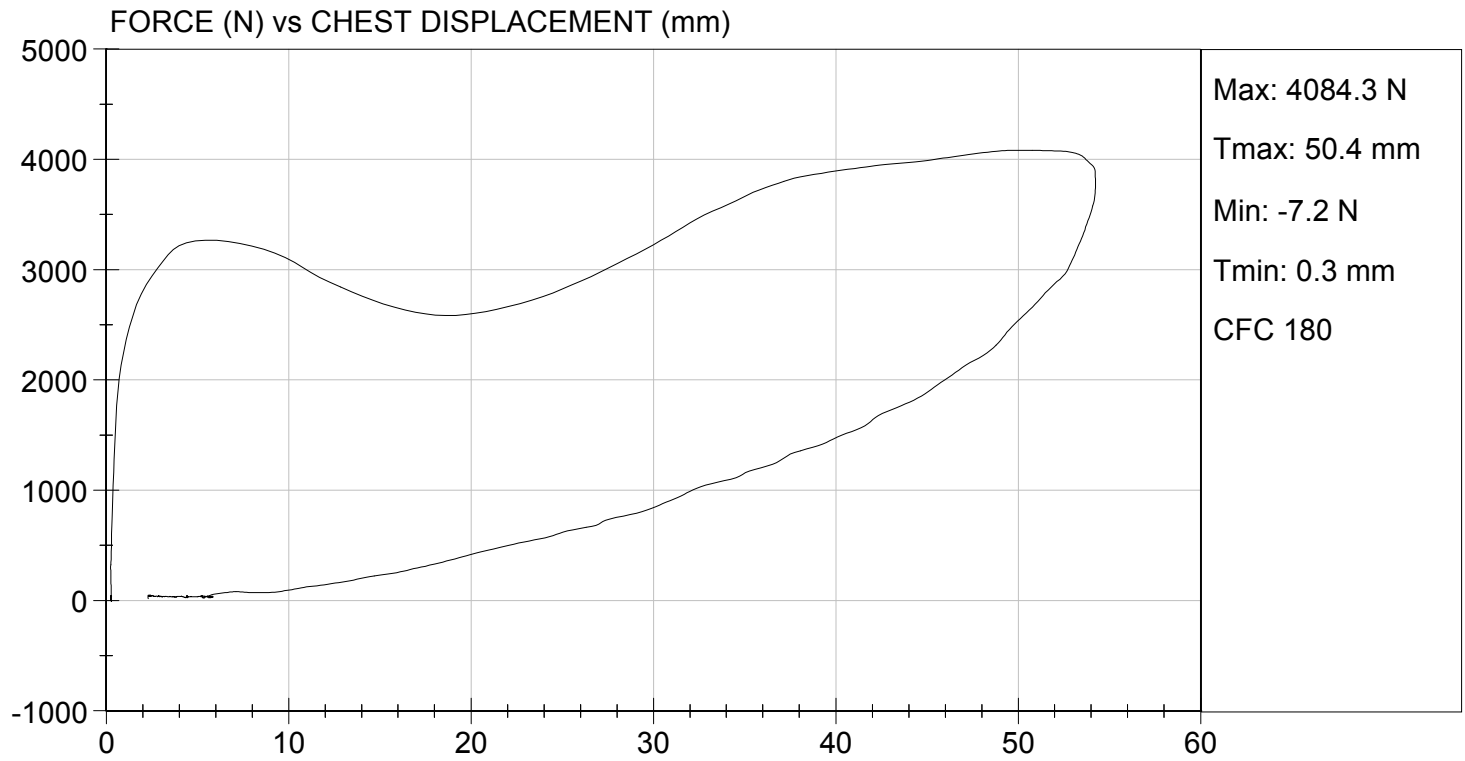
Test Date


Approved By



TEST DESC: THORAX IMPACT
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 07/09/2013
TEST #: D132204



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138

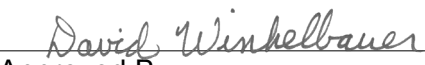
Test I.D: D132205

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.0	Pass
Laboratory Relative Humidity	%	10 to 70	50	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	N	3450 to 4060	3781	Pass
Overall Test Results				Pass


Laboratory Technician

07/08/2013

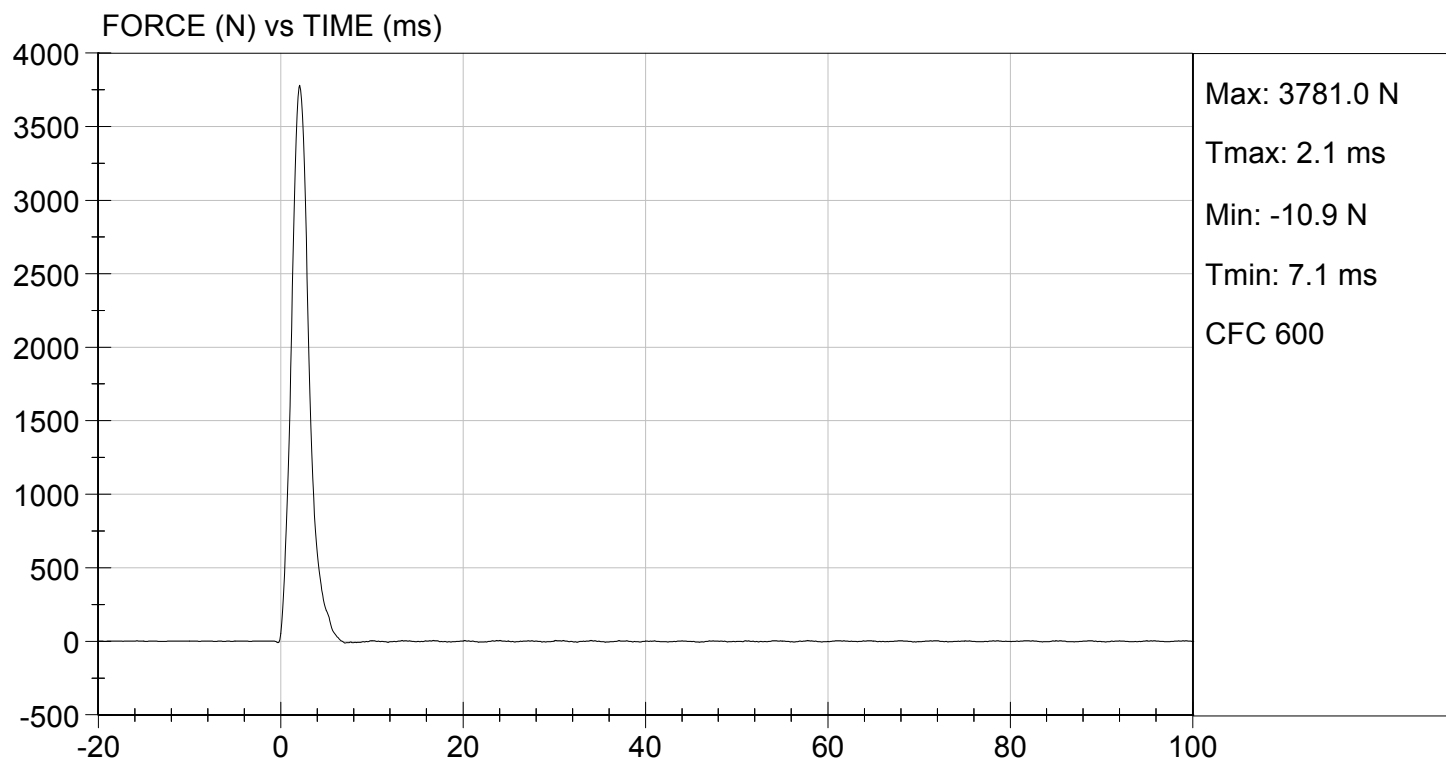
Test Date


Approved By



TEST DESC: RIGHT KNEE
VELOCITY: 6.97 ft/s, 2.12 m/s

TEST DATE: 07/08/2013
TEST #: D132205



MGA RESEARCH CORPORATION

**LEFT KNEE IMPACT TEST
HYBRID III 5TH PERCENTILE**

ATD Serial No: 138

Test I.D: D132206

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.0	Pass
Laboratory Relative Humidity	%	10 to 70	50	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	N	3450 to 4060	3797	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

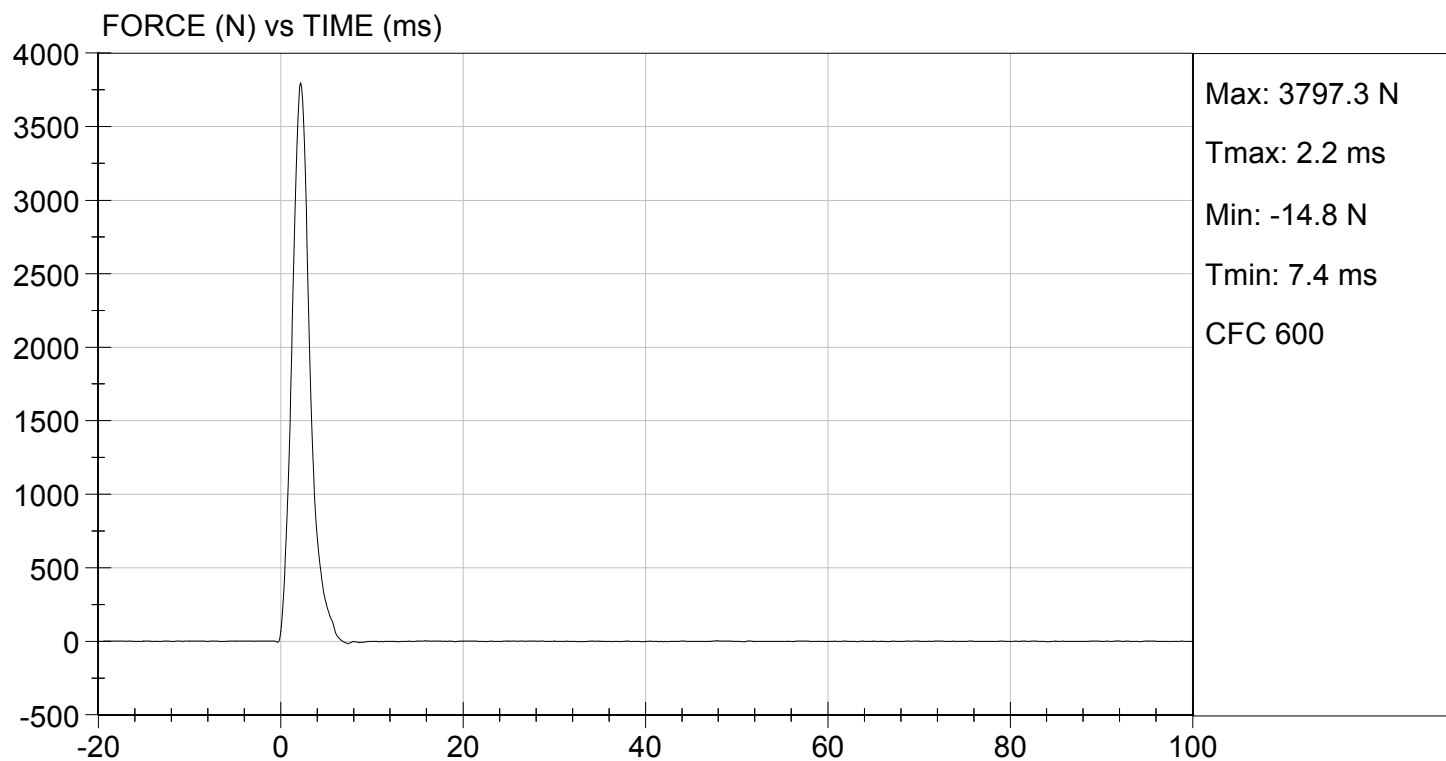
07/08/2013
Test Date

David Winkelbauer
Approved By



TEST DESC: LEFT KNEE
VELOCITY: 6.97 ft/s, 2.12 m/s

TEST DATE: 07/08/2013
TEST #: D132206



MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138

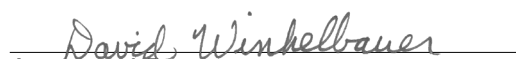
Test I.D: D132207

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.0	Pass
Laboratory Relative Humidity	%	10 to 70	53	Pass
Initial Angle	deg	0 to 20	17	Pass
Return Angle	deg	+/- 8	1	Pass
Force at 45 deg	N	320 to 390	376	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.9	Pass
Overall Result				Pass


Laboratory Technician

07/08/2013

Test Date


Approved By